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THE IRON TRADE REVIEW.

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CLEVELAND, O., SEPTEMBER 3, 1891.

THE WEEK IN IRON CIRCLES

General Features. A better undertone is apparent in all the branches of the iron market, but nothing yet appears on the surface. Business drags even more than during the midsummer period Inquiries are slack and new transactions are mostly small. Under ordinary conditions, a situation like the present would develop a good deal of speculative spirit; that, however, is completely wanting. The more certain it appears that the very bottom has been reached and that the future is full of promise, the more hesitating buyers become. It is believed that a short period of easy money markets which are already upon us, will, to some extent, remove this extreme conservatism and start up at least a normal condition of activity. In the buying that has been going on at Cincinnati, charcoal irons have shared quite freely. Some good orders have been placed for Southern brands and for Lake Superior charcoal iron, and further inquiries are on foot. In Southern coke irons, prices continue to drag, but have already got so low that further decline seems impossible. There is no important change in productive capacity either South or North. The improvement at Louisville, noted in our last report, seems to be gaining ground. There is a greater inquiry apparent, and buying a shade more free. The indications now are that the great activity predicted for this Fall and Winter in all branches of the iron trade, may shortly be realized, and that there will be a revival of business before a great while. The railroads throughout the country are being greatly benefitted from the movements of farm products, as indicated by the enormous increase in traffic, and their large earnings. Bar iron has moved up slightly in the West and sales have been made at advanced prices. Furnaces seem to be taking things quietly, not specially pushing their product on the market, and prices remain in about the same condition as noted for some time past. At Chicago the market for the past week has shown some improvement over the previous one; inquiries for Southern coke and charcoal being quite numerous. While no very large orders have been booked, there has been a fair run of business for nearly all grades. The short car supply in the South continues to annoy shippers and cause consumers no little inconvenience. Lake Superior charcoals continue firm. The general situation at Detroit remains dull and unchanged, and while nearly featureless, the steady undercurrent of small orders is occasionally disturbed by a good-sized deal. We hear of two transactions closed for one thousand tons each Lake Superior iron, for delivery before the close of navigation, and the number of inquiries seen for additional lots should show a more active market for the first week of September. Southern furnaces have been hurrying forward all of the iron possible for their Northern consumers, owing to an advance in freights of fifteen cents per ton the present week. This was generally on old orders, however, very little new business being developed. While as yet no improvement whatever is seen in prices, the continued favorable crop reports, the revival to a certain extent of speculation, the necessarily large business during this Fall and Winter of the railroads, leads furnacemen to believe that a change for the better is not far off. There has been a fair run of pig iron orders at Buffalo, this week, mostly for carloads and fifty or one hundred-ton lots for immediate or early delivery. No pressure to sell is manifest among furnaces and stocks on yards generally are not large. Indications point to an advance in freights from Ohio and the South on September 1st. This has restricted offerings quite materially. The consumption of iron in the St. Louis market continues light, and consumers are indifferent about providing for future wants. Money is decidedly easier in leading Western centers. Indeed, some banks have found it rather difficult to make satisfactory disposition of surplus funds. There is no change of rates on time loans, but call money is very cheap. There is no doubt that if the agitation for cheaper money were removed, confidence would quickly return to the financial world and all branches of industry feel the stimulus. Railroads continue to hold off, and the iron trade has begun to learn to expect but little from that quarter.

The Local Situation. The present condition of the pig iron market is undoubtedly due to an incomprehensible diminution in consumption, incomprehensible in the sense that nothing can be found to show a detailed falling off anywhere or at any particular point; yet the stubborn fact remains that the furnaces are turning out more iron than the market seems well able to digest, which in effect means the same thing, since the furnace capacity has nowhere been increased. The future of the market is one of the problems that can only be solved by itself, the conditions varying altogether without regard to what ought to be logical reasons, and assuming situations diametrically opposed to all established custom. For just a year there have been persistent reports of better times, yet those who are hopefully inclined are as strongly convinced as ever, that the future must needs bring an improvement—for the reason, perhaps, that the worst has come to pass—but the fact remains that no betterment has been recorded up to date, and if the good times to come should really make their appearance, none would be more surprised than the very people who have been looking for them. It is so with the Southern furnaces who, five years ago, were said to be on their last legs, but who continue to grind out iron day after day, in the face of a hundred assertions that they are losing money on every ton of metal they produce. The market is certainly weak, and yet no reason can be assigned to it that will hold good in a general way. The time is approaching for the movement of the enormous crops, and the railways will be more than busy. They have not bought any material as yet, and their requirements, for replacements and new equipment, will be large. No one looks for higher prices, although that is a matter that will necessarily adjust itself with the better demand. Yet, despite the poor season, most furnaces report their sales for the year pretty closely up with those of last year. The pig stocks of the association, as reported up to date, show about 300,000 tons on hand Sept. 1st, as against 267,500 on Aug. 1st, and 235,500 on July 1st. The corresponding figures for 1890 were; Sept. 1st, 390,000 tons; Aug. 1st, 425,000; July 1st, 402,000 tons. The consumers of pig iron are hopeful, and report plenty of small orders, but none have work that would justify them in buying heavily, so that their uncertainty keeps them out of the market, except for car lot orders. It may be noted, however, that iron for December delivery is stronger by a dollar than the ruling market price, and while no sales worth speaking of are being consummated at the higher figure, its presence indicates the position of the furnacemen, and the confidence they have in the stability of the business, poor though it is. In the meantime, the producers of coke are asking full prices; the promised reduction in rail freights has not materialized, and lake freights are as high as ever. In the lines of manufactured iron there is very little to report. The demand is very good, and in many instances mills decline to accept orders for delivery prior to January 1st, but the price is low, and the profits are correspondingly small in everything except combination shapes, which are strong at the full rate.

CANADIAN CHARCOAL IRON.

In view of the inroads of American pig iron upon the Canadian markets, interest will attach to the effort now being made to develop the charcoal iron industry in the Dominion. From a recent interview in *Hardware* (Toronto) with Mr. Drummond, of the Iron Furnace Company, Radnor, Que., it appears that American, English and Scotch capital is being combined to improve the existing works, for which purpose the sum of $50,000 is being immediately expended. The company proposes to use mainly bog ore, very rich beds of which have recently been opened up on the south shore of the River St. Lawrence. The company is not, however, confined to lake and bog ore for supplies. On the Upper St. Maurice they have located large deposits of magnetic iron, and though containing some titanium, there are samples found quite free from this mineral. Prospecting is going on under the direction of the company, who have made arrangements for working other deposits of magnetic and hematite ores of high quality in other parts of Quebec and adjoining lands in Ontario, which, it is claimed, they can lay down as cheaply as many United States furnaces can lay down Lake Superior and other ores. Of the charcoal supply, Mr. Drummond says the resources are enormous, virtually inexhaustible and easily available to his company's furnace. In the St. Maurice district, along the St. Maurice River itself, to the north, and along the course of the Bas Laurentide Railway to the south, the soft woods suitable for making the best charcoal will yield a supply for ages. The wood standing in that region now is not suitable for the purposes of either the lumberman or the settler, so that charcoal making is the industry that must afford a market for it. The experiment will be regarded with interest from this side of the border.

Referring to the languishing state of iron industry in Canada, an intelligent writer in the Glasgow (Scotland) *Herald* says:

> The Canadian government appears to be determined that this reproach shall be got rid of. They have recently increased the duty on pig iron, and have offered a bounty to capitalists who are prepared to engage in the manufacture of that metal within the Dominion. Not only so, but local authorities have offered special inducements to undertake this industry in the form of exemption from taxes for a term of years, and the railway authorities have offered excellent terms of transport. It would be rather remarkable if under these circumstances capital were not attracted to so promising a field of operations. Canada has apparently made up its mind that it will in future supply its own iron and steel to a large extent.

The writer in question is strongly impressed with the advantages of Nova Scotia, not only on account of the proximity of the coal and iron to the manufacturing center, but also to the harbor of Pictou, where shipments can be made the year round. It will be interesting to note the effect of the present efforts to revivify an industry which, for some reason or other, seems never to have obtained a substantial foothold in the Dominion.

VIRTUE ON A PEDESTAL.

Our New York contemporary, the *Metal Worker*, is made the object of attack on the part of the *Un-American Artisan*, because of its defense of Mr. Niedringhaus, the St. Louis tinplate maker, in his inconsistent attitude of attempting to import foreign labor in preference to employing American workmen. The *Metal Worker's* position is contrasted by the *Artisan* with that of *The Iron Trade Review*, which is pronounced more consistent in insisting that an American industry should be built up with American labor. Noting the divergence of opinions between the *Metal Worker* and *The Iron Trade Review*, the *Artisan* says:

> It appears now that not only will it be necessary for Mr. Neidringhaus to "readjust" his views in relation to the purposes which protective measures are intended to serve, but that the paper which champions him—presumably for revenue only—will also be compelled to sing its recantation if it desires to maintain its assumed character as a champion of home enterprise (or advertisements).

This is, indeed, a center-shot (if true, which we doubt to the point of disbelief). A public journal that will mould its opinions for or against home enterprise on the basis of the advertisements which it receives or hopes to receive from American manufacturers, has gotten down as low in the moral scale as it is possible to conceive. But no. There is a still lower depth to which a paper can sink, and that is to cry down home enterprise and, as a reward for its disloyalty, solicit and accept the advertising favors of foreign enemies of American industry.

THE FOREIGN IRON AND STEEL SITUATION.

Dullness seems to characterize the world's markets. Besides being dull, the tone of the English market is weaker. The decline in pig iron is not so very marked, and not likely to become so, owing to the inability of producers to make concessions. Consumers still continue to take only the smallest quantities. Speculation in pig iron seems for the present almost dead, and warrants vary little in their value. It is asserted that the London "ring," which is holding large quantities of Scotch pig iron for speculative purposes, is destined beyond question to fail. It is calculated that, including interest on borrowed money, store rent, and brokers' commission, the holding of Scotch pig iron warrants is costing the metropolitan syndicate at the rate of upwards of £60,000 a year. Great depressment exists in the Newcastle steel trade. The outlook for Winter in Workington is most distressing, as there are at present between 200 and 300 houses standing empty, and about 6,000 men and boys out of employment, many of whom have earned no wages for over twelve months. As is to be expected, great distress prevails among the unemployed. Prices of finished iron are maintained, but the demand is no better. Steel, on the other hand, is easier, owing to the dull inquiry. Shipbuilders are able to go on, without any pressure.

On the continent, the Belgian iron market remains dull. There is a current of contracts, but they are mostly for small quantities only. Although official quotations are unaltered, selling prices are below them. The French iron market continues quiet, but it is fairly steady, owing to the fact that in some districts ample orders are still on the books. The German iron market remains practically unchanged, although a slightly improved movement in pig iron is reported from Westphalia. Business in Silesia is duller. Producers both of pig iron and finished iron are not very anxious to sell, owing to the unremunerative prices ruling.

FOREIGN APPRECIATION OF AMERICAN GOODS.

American polished shafting seems to be in demand in Great Britain, judging from an order recently received by the Mahoning Valley Iron Company, of Youngstown, O., particulars of which are given in the following letter from the company in answer to an inquiry by *The Iron Trade Review*:

> Answering yours of the 29th, we would say that in giving the item to our newspapers here, we did not state that the order received from England for our polished shafting, was a *large order*, for it could not be truthfully so termed. Yet it was eminently satisfactory to us to receive it, as we hope that it may prove to be the forerunner of many other orders from abroad. No reasons are assigned for the placing of this order with us.

That Cincinnati manufacturers have lately received from abroad important orders for wood and iron-working machinery has been noted in these columns. A correspondent of this paper sends the following note of more recent date:

> The readers of *The Iron Trade Review* have seen items in this paper showing how our foreign trade has been increasing since January 1, and to quite an extent with manufacturers in Cincinnati, O One feature of this foreign demand is that it comes from some of the countries still under and governed by England, whereas it would be in some particulars very natural that its colonies would trade with the mother country, instead of sending orders to this country. H. L. Shepard, Agent, 134 East Second street, Cincinnati, O., has received an order from Demerara, British Guiana, for one of his lathes and a complete outfit for same amounting to several hundred dollars, and as well another order from another of England's colonies, Port Rico, West India Islands, for a like outfit. Mr. Shepard has an order from Stockholm, Sweden, for one lathe and outfit. Mr. Shepard says that all these orders have come to him since the reciprocity features of the new tariff law have become effective, and this is only one of several orders he has received from foreign countries, and is another indication that these wise measures are proving more and more of a success. J. P. G.

These are straws showing which way the wind of trade blows, and are gratifying even if, singly and alone, they may not seem to amount to much.

THE iron industry is to be given full attention by Chief Skiff, of the Department of Mines and Mining, of the World's Fair. There will be shown all the many varieties of ores, with full data as to the location and extent of their beds, the analysis of each ore, and, so far as possible, the different processes of treatment in the manufacture of iron and steel.

A CHATTANOOGA concern is now turning out Bessemer steel at the rate of 300 tons per week. The steel industry in the South is making slow, but steady progress.

ONE of the most prominent boiler makers in the country says that the tendency of the day among manufacturers is decidedly toward higher pressure boilers.

ELECTRICITY is next to be used in drilling holes in boiler and ship plates.

THE ESTIMATE SYSTEM OF PAYING WAGES.

Mr. John Richards, is his journal *Industry*, comments upon Mr. Halsey's paper upon the premium plan of paying wages, and says it is only a clumsy adaptation of a plan which has long been used in England, and which he thinks is much superior to Mr. Halsey's or any other plan in use in this country. Mr. Richards says that he has heretofore explained the system at some length, but that no one here seemed to understand it, and we are not sure that we now understand it any better than before, for the reason that some of the features of the system seem much more complicated than any other we know of, without compensating advantages so far as we are able to perceive.

It is called the "estimate system," and, according to our understanding of it, may be described as follows:

When an engine or other machine is to be built its selling price is divided into four parts: material, labor, expense and profit. The cost of the material is found by estimation, in the manner that is familiar to all manufacturers; expense is estimated from precedents, and profits are assumed at a fixed amount. The cost of the labor is estimated by means of tables and fixed rates for the performance of the various operations, these rates being fixed in England "by the concurrence of wide districts, and the precedence of many years." The rates and the methods of computing the labor cost are declared to be entirely familiar to and well understood by both employers and workmen, such shop processes as casting, forging, turning, drilling, planing, fitting and so on, being classified and subdivided into grades, for which different rates are allowed.

For example, planing and turning are divided into four grades, for each of which there is a different rate for each 100 inches of area, and so on for other processes, casting being rated by the pound at different figures, according to the class of work, plain, gear, cored work, etc. Forgings are rated by the pound, and pattern work as a percentage.

During the progress of the work in the shops the men are paid a daily or weekly rate of wages, and the time spent by each man on any certain job is carefully recorded. When the job is completed the wages which have been paid out during its progress are deducted from the original amount allowed for the cost of the work, and the difference is paid to all who have participated in it, in proportion to the time put in on the job, and to the rate per day for each man, which, of course, varies with the class of work done, and individual ability.

The results of the system are summarized by Mr. Richards as follows:

(1.) The owners are relieved from the responsibility of the "rate of wages" among the workmen. The men themselves see that this is equitably graded and in proportion to capacity.

(2.) The owners are also relieved from the care of seeing that men perform a day's work. This is also looked after by the workmen themselves. Any one not doing a fair day's work is reducing the "surplus" and robbing his fellow workmen.

(3.) The owners are also relieved from losses from spoiled or "scamped" work, also from breakages due to ignorance and negligence. The men make these good.

(4.) The workman can favor or support anyone who is unfortuntae, or incapacitated by accident or sickness from doing a full day's work. The system may thus be made a benevolent one.

(5.) The owners "know" what the labor will cost, and consequently know what their profits will be, if other elements are up with equal exactness.

(6.) It constitutes the workmen interested partners, in so far as their work goes, without any object or desire to participate in other things, such as material, expense or profit. It also creates a feeling of personal responsibility among workmen, that is unknown in any time system.

(7.) It furnishes standards for "tool performance," and acquaints both workmen and owners with the merits and capacity of implements. The day's and hour's work of machines becomes known to both users and makers, hence it is common in England to specify capacity in tenders for machine tools.

We know of at least one prominent concern in this country where a system similar to this has been in operation for a number of years in the case of new machinery, *i. e.*, machinery differing more or less from any that has preceded it. The bulk of the work is done on the ordinary contract system, and when a new machine is to be built a price for doing the work is fixed by mutual agreement between the proprietors and the men doing the work of the class to which the new machine belongs. The price is based upon experience with other machines as near like it as can be selected, and the ordinary income of the men is guaranteed, with the privilege of making as much more as possible. But it is worthy of note that if there are other machines built afterwards of the same kind they are built by contract.

We do not just see how wide districts or the precedents of many years can well be recognized in making up estimates of cost of work in this country, for the simple reason that the cost of work is constantly and rapidly decreasing in most instances, and it differs considerably in different parts of the country, and even in different shops in the same locality, so that it seems to us that estimates would be much better made upon a basis of the experience in the shop where the work is to be done alone.

With either system unreasonable men on either side can defeat the object in view. The English system certainly would require very much more bookkeeping than any other with which we are acquainted, but, as Mr. Richards says, bookkeeping is cheap there. The system certainly has its good points, one of which is that it can be applied to machines built for the first time, which, perhaps, would not be so easy with the system proposed by Mr. Halsey, though in this country it is common knowledge that turning, planing, drilling and other such operations cost far less on the fiftieth or the hundreth machine than on the first one, and we do not notice that the English system allows for this any more than does that of Mr. Halsey, for with either of them a time would come when a readjustment would be demanded by one side or the other.

The best feature of the estimate system seems to be that it makes it to the interest of each man in a shop to see to it that every other man does a fair day's work, and, when he does it, relieves him of responsibility to those who, in the nature of the case, must know far less of what constitutes a fair day's work than the men themselves.—[American Machinist.

COMMENTS OF CONTEMPORARIES.

The Iron Trade Review in its last issue presented figures showing that Cleveland received but 20 per cent. of the total receipts of ore at Lake Erie ports during the full season of 1890, while all other ports show a gain in receipts. The aim is to call attention to Cleveland's steady loss in receipts as compared with other ports. While it is true that a lack of facilities here has resulted in great loss to the city, the comparison this season is of light value, as labor troubles early in this season caused idleness on the Cleveland docks up to June, while delay from the same cause at Ashtabula and other places was comparatively of little significance.—[Marine Review.

Those British manufacturers who intend being represented at the forthcoming World's Fair, at Chicago, are advised by Mr. John Wilson, ex-M. P., to send the best goods they have in stocks, and to mark them at cost price. By this means Mr. Wilson thinks "people would see what Great Britain could do in providing good, elegant and cheap materials; and they would also see how it was that they had to pay so much more for them over in America than in this country."—[Glasgow Engineer.

The Cleveland, O., *Iron Trade Review* quotes the foregoing and comments thus:

"To heighten the effect and emphasize the contrast, how would it do for British exhibitors to frame and hang up in a conspicuous place comparative scales of wages as between British American workmen, also a few photographs showing the beauties of women and child labor in English iron mines."

And then, by way of another picture, there might be a vivid sketch of the pleasures of a 12-hour turn in an American Bessemer mill, showing the men breaking the record of output, and giving the result of how it breaks them down and builds palaces for the employers, to turn out 2½ to three tons per man to one ton turned out in a British Bessemer plant. To complete this the brush and pencil should delineate in portraiture the refining influence this system has on the employer and his progeny, and the other sort of influence it has on the employee and his progeny—the sketch to be taken to describe these conditions after another generation of time and straining work have added their effect to that which is now constantly going on —[National Labor Tribune.

Recovery of Iron from Slag

A process for the recovery of metallic iron from slag is thus described by W. J. May:

"In very many cases the slag as taken from the furnace will be found to contain a large amount of iron in a metallic state, and which would well repay for any moderate outlay in its recovery; but one of the primary points is that all the work must be as nearly automatic as possible. The separation of the metal from the slag offers no difficulty, as a magnetic separator having a series of magnets, part of which are out of current at all times, the whole of this business is quite automatic. The troublesome part of the affair is the disintegration of the slag, and where this has to be taken from the old banks it is a tough job, and an expensive one, to get in pieces sufficiently small to be first passed through a stone breaker and then milled. The process I should personally adopt is as follows: Two fairly large pools of water about ten feet deep would be formed, and run out over these would be a couple of truck topplers, having the roads of which they formed the ends at a fair height above water. The slag truck would be 'kicked' onto one of these by the engine, and the slag 'ball' in its semi-fluid state would be cast into the water, causing somewhat of an explosion, no doubt, but at the same time being broken up into small portions. Of course, no one would be near enough to be scalded at the time. When one pool of water was sufficiently full the water would be run off, the slag trucked up to the mill where milling was necessary, and the pool put in readiness again to receive the slag, after which the other pool would be emptied, and so on. This would save the first cost of blasting the cold slag, and although a crude way of working, would be effective for the purposes intended. The milling and crushing processes would only be continued to the point where the most effective result would be had, and the total cost should be repaid by the recovery of 2½ per cent. of metallic iron, anything over being profit."

Outing for September comes to hand crisp and refreshing, as though borne upon the first cool breeze after the wearisome glare of the dog days. Every article in it is well written, interesting and wholesome. This magazine encourages a love of nature and pure sport by placing withing the reach of all the literature of forest and stream, mountain and plain. The September number is, as usual, embellished with many beautiful illustrations. The contents are: "On the Plains of Assinboia," by "Nomad;" "Trouting in the Metis Lakes," by C. J. Colles, M. D.; "Running High-Jumping" (Part II.), by Malcolm W. Ford; "A Coon Hunt," by Alexander Hunter; "A Love Match," by Wm. Earle Baldwin; "Canoeing on the Miramichi" (Part II.), by Rev. Wm C. Gaynor; "The Massachusetts Volunteer Militia" (Part IV.), by Capt. Dan'l Morgan Taylor, U. S. A.; "Yacht Clubs of the East" (Part II), by Capt. A. J. Kenealy; "Some Modern Achievements of the Camera," by W. I. Lincoln Adams; "A Day Among the Prairie Chickens," by Geo. Taylor; "The Home of the Red Deer in England," by Charles Turner; "Harry's Career at Yale" (continued), by John Seymour Wood; "Caught by a Wheel," by W. G. Calderwood, and the usual editorials, poems, and "Records" by the standard writers on sport, etc.

BRIGHT OPINIONS ON THE FINANCIAL SITUATION.

President J. Edward Simmons, of the Fourth National Bank of New York City: "The United States is at present in an exceptionally fortunate position, from a financial and commercial point of view. We have an immense crop, the larger part of which has already been successfully harvested, so that to a great extent fear as to its safety has no ground for existence. At the same time there is an immense foreign demand, the result mainly of the complete or partial failure of the crops on the Continent of Europe and in Asia. Unquestionably a great export of wheat and of other cereals and food products will take place during the ensuing year from this country to Europe. It will be remembered, that during the past six or eight months we paid seventy millions of our indebtedness to foreign nations. Now, considering the amount of food products we shall send abroad as a result of this unusual crop and of the foreign shortage, a very considerable amount of gold must be returned. The balance of trade will undoubtedly be adjusted in gold, and hence I look for the return of a very large part of the precious metal that has recently left this country. The foreigners have sold their speculative securities and they have now nothing left but the investment securities. I do not believe they will sell their investment securities, for they could not put their money where it would be safer. Europeans will probably send us some of the 4½ per cent. Government bonds that are now coming due."

Lyman J. Gage, President of the First National Bank of Chicago: "The enormous wheat and corn crops are just what the country needed, and I look for a period of unexampled prosperity. There will in the near future come into the hands of the producing element of this country one thousand million dollars more than the usual amount earned by that class. This will mean that the farmer, who until now has had all he could do to make both ends meet, will find that he can not only make them come together, but that he will have a neat little sum left over. Probably the search for new investments will take many people into Wall street again and business there will revive. It is bound to be so. Capitalists will seek new ways in which to invest their money that has been returned to them by the farmers in taking up their mortgages. Where can they go to save to Wall street and to the many industrial companies that are being formed."

James B. Canby, President of the Commercial Exchange, of Philadelphia, Pa.: "The results of the recent prosperous wheat, oat and corn crops of the United States seem to point to the greatest amount of money being realized by the farmers of the country that they have received for many years. Owing to the shortage of the crops in other countries and their necessities, which will compel large exports of cereals from this country, the transportation companies will be enabled through this heavy trade to maintain better relative rates than have prevailed for the past ten years. This should cause the earnings of all the railroads to be heavily increased. It would seem impossible that the European markets should not be obliged to send back to this country nearly all the gold recently exported. Indeed, I believe that the importation of gold from this source alone will reach at least $100,000,000."

Asa P. Potter, the president of the Maverick National Bank, Boston, Mass.: "The effect of the large crops upon the country goes without saying, almost, as bringing on a universal advance in prosperity. The people abroad are as human as here, and when they see the large crop advancing the price of railroad securities here, they will hold on to what they have and the price will go up in London. People don't often sell when prices are going up. This will send the gold over in a stream."

E. Francis Hyde, Vice-president of the Central Trust Co., New York City: "Undoubtedly the general prosperity which will result from the abundant crops and the European shortage will stimulate the organization of new companies and investment in those already in existence. Taking England and the United States together, the net savings of the people this year will probably amount to $1,000,000,000 each, and these savings must be invested somewhere. As for the silver question, the abundant crops may tend to postpone its consideration. We should be glad to have both gold and silver at all times in circulation on equal footing. We think that they will continue to do so, but if our financial system is ever put on a silver basis we must do as every one else will be obliged to do, adjust our business accordingly."

THE MAKING OF MALLEABLE CASTINGS.

Angus Sinclair writes the *National Car and Locomotive Builder*: A visit to the works of the Cleveland Malleable Iron Works at Cleveland, gave me some genuine surprises in witnessing the extent to which this industry has been carried. The extent of the works is enormous and they appear to supply articles for nearly every industry in the country. Hundreds of things that most people have been accustomed to consider as being forgings of iron or cast steel I found on going through these works to be malleable iron.

It is probably the fault of those who are engaged in making malleable iron castings that there is such a widespread misunderstanding of what malleable iron castings are. Many people who are in a position to order malleable iron where they consider it suitable, are under the impression that this material is a common casting, subjected to an annealing process that increases its toughness in proportion to the time and care bestowed upon the annealing operation. If those interested in selling malleable iron would take the mechanical world more into their confidence there would be less prejudice against the material.

Some 70 years ago there lived in Newark, N. J., Seth Boyden, a blacksmith by trade, who became a sort of Admirable Crichton in everything relating to the mechanic arts. This man, besides possessing great inventive and mechanical ability, had extraordinary acuteness of observation. When yet a lad he saw that a grate bar which was taken out of a furnace had apparently changed its quality on the part exposed to the fire. He broke off the part that appeared to have undergone metamorphosis, and found that it could be drawn on the anvil. By some unknown process the cast iron had become malleable. Boyden proceeded to search for the secret of the change. All his spare hours were devoted to the search, and after long and tedious experiment he found out that when cast iron of a certain quality was kept at a high temperature surrounded by oxide of iron, the cast iron lost its high percentage of carbon, and became soft and malleable. Unless the proper mixture was used in the cast iron, cementation made the iron worthless.

The great malleable iron industry that can be seen operating on such a large scale in the Cleveland Malleable Iron Works is part of the outcome of Boyden's discovery. Until a few years ago, there was scarcely any malleable iron used in railroad machinery, but its introduction into this line has gone on very rapidly. Ten years ago when Mr. George W. McGuire joined the Cleveland Malleable Iron Works, only a few tons of their product went to railroads. Last year over 10,000 tons of these castings were made for railroads, and the demand for this material in drawbars promises to double the supply for railroads in the current year.

The castings are made in dry or green sand molds that do not differ materially from ordinary cast iron molding. The iron is poured very hot and the product is a shiny, gray, highly brittle casting, these characteristics being principally due to the selection of pig iron. The castings are then taken and put into square boxes, where they are imbedded in oxide of iron, mostly in the form of iron scale purchased from rolling mills. The boxes are put into furnaces and gradually raised to a high temperature, the limit being only short of the melting temperature of the iron under treatment. The higher the temperature maintained, the better the product. The boxes are kept in the furnace seven or eight days and then allowed to cool slowly. As soon as the castings can be handled they are ready for cleaning.

There is considerable difference of opinion among metallurgists as to the rationale of the process. The prevailing opinion is that the decarbonizing material, when kept at a high temperature, removes from the part of the iron penetrated the carbon, sulphur, silicon and manganese by a process of oxidation. An eminent chemist, however, who has given the subject profound study, attributes the change in the physical properties of the castings after the treatment to the separation of amorphoris graphite within the metal, without which separation he holds that the castings will remain brittle when the amount of carbon is decreased to the usual extent. Be this as it may, the practice of cementation with oxide of iron on the proper castings produces a very tough casting that is filling a highly important place in American industries.

Mining and Iron Industries at Bosnia.

According to the organ of the Austrian Commercial museum, the lignite mines in Zenica and Tuzla, Bosnia, are gradually increasing their production. This kind of fuel is exclusively used in that country for locomotives, in a few industrial establishments, and for domestic purposes. It is believed that steam coal has also been found in the Tuzla district. The production of the newly-started lignite mines, near Konjica, is as yet very small. The "Bosnia" Society has recently, in addition to that near Cevljanovic, opened up two new manganese mines near Benjaluka and Konjica. The few mines producing chrome ore, antimony, and argentiferous lead have made but little progress during the past year. In the iron trade the provincial Government is erecting new iron works on modern principles. The installation comprises a blast furnace near Vares, and a foundry and forge near Dabrivina.

Iron Paper.

It will not, perhaps, be remembered, says the *Paper Maker* (London), that in the great exhibition of 1851, a specimen of iron paper was exhibited. Immediately a lively competition ensued among ironmasters as to the thinness to which cold iron could be rolled. One ironmaker rolled sheets the average thickness of which was the 1-1800th part of an inch. In other words, 1800 sheets of this iron, piled one upon the other, would only measure one inch in thickness. The wonderful fineness of this work may be more readily understood when it is remembered that 1,200 sheets of thinnest tissue paper measures a fraction over an inch. These wonderful iron sheets were perfectly smooth and easy to write upon, notwithstanding the fact that they were porous when held up in a strong light.

Iron and Steel Works in China.

As previously stated iron and steel works for the construction of steel rails for steel railways, steel for gunfounding, and mercantile iron, have been begun near Hanyang, on the western bank of the Han River. The masonry for blast furnaces, both by the Bessemer process and by the Siemens-Martin process, is being rapidly constructed, and machinery from England has been ordered. Much of the machinery has arrived at Shanghai, and is only waiting for the river to rise to be brought to Hankow. In February there were two locomotives at the works, and about three-quarters of a mile of railway laid. The works are situated on the River Han, and arrangements are being made to have a jetty on the Yangtze, a little above its junction with the Han.—[Indian Engineer.

A New Use for Tubes.

A new use has been found for tubes produced by the Mannesmann process, says the London *Ironmonger*. At the funeral of Count von Moltke the troops were equipped for the first time with lances, the shafts of which, instead of being wood, as usual, were formed of very thin steel tubing, made at the Mannesmann works. The tubes are, it is said, actually lighter than wood, while at the same time possessing much greater elasticity and strength. The only drawback appears to be less secure grip which the metal surface offers as compared with wood.

LAKE SUPERIOR MINING NOTES.

The steamer of E. C. Pope left the Central ore docks yesterday afternoon with the largest load of ore on board that ever left a Lake Superior port. She had on 2,800 tons. This boat has been doing good work this season. On her return trip she averaged a trifle less than fifteen miles per hour with a full cargo on board. Vesselmen call her the best steamer on the lakes. She is 337 feet over all with 45-foot beam and a depth of hold of 24 feet. Her machinery is further aft than in most boats, which allows her to carry considerable more ore. She is a new boat fitted with electric lights and other conveniences and cost $225,000. The boat has made a splendid record for herself this season.—[Ashland News.

The Dunn mine has so far made an output of about 105,000 tons, which leaves good time to accomplish the shipment of 50,000 tons, which will even with the output of last year. The present daily shipment averages 1,000 tons from mine and stockpile, and could be held at 1,600 if cars were supplied. The present hoisting is 800 tons daily; this will soon be raised to 1,000 tons by reason of new ground which is being opened at the north end of the property. At the depth of No. 3 shaft—380 feet—a drift runs north and at a distance of 130 feet had just cut the ore, the extent of which is unknown. This will be opened at once and will increase the hoist at least 2,000 tons, this, too, without an addition to the working force. The open pit at the south end is being cleaned out to a depth of 200 feet. A drift is to be driven through on the 300 foot level, and the ground under the south pit will also be cleaned out, leaving ceiling and floor to augment future work. The same line of work will be done in the fourth level at a depth of 380 feet.—[Diamond Drill, Crystal Falls.

At New York there is but little stockpile room left and if sales are not soon made mining operations will have to cease. The company has not shipped a pound of ore this year. Underground, the condition of things is gradually growing worse. Each day finds the workings nearer the Cleveland and Cliff companies' lines, and the time is not far distant when operations will have to be confined to the removal of pillars. Three years, at the outside, probably, and the old New York will be declared exhausted of its treasures.—[Iron Ore.

The King Mining Co. is the title of the latest organized to explore the East Negaunee range. Ground was broken this week and the shaft has reached the ledge, the latter being covered by a few feet of drift. This property is located about 800 feet to the north of the Barassa shaft, and it is for the Barassa deposit they are searching.—[Iron Ore.

Operations have been resumed at the Hawkeye, which is located a short distance to the east of U. S. Grant, a shaft has been commenced and three sets of timber had been put in place at the time of our visit. Some time ago they tested the ground with a diamond drill and reported the finding of 25 feet of 64 per cent. ore at a depth of about 40 feet from the surface.—[Iron Ore.

What was expected would prove a paying deposit of ore at East Jackson, proved to be of small proportions, and lean ore has again been met with. The quartz still persists in coming in, and rendering the ore worthless. There is a winze 200 feet from the shaft that shows some clean ore and it is hoped it will lead the way to a merchantable deposit. The shaft is 212 feet deep. The company has a few hundred tons of ore in stock, this representing a large amount invested in a plant and underground drifts.—[Iron Ore.

The Glidden Co., of Cleveland, interested in the Hope propetry, this district, is conducting extensive explorations between Lake Mary and the Michigamme river, about three miles below the Mansfield mine, under the able superintendency of C. H. Phelps. The present shaft is 115 feet deep, and will go to 140 feet when drifting and crosscutting will be inaugurated. The formation at this point has an almost east and west course. The shaft in course of sinking encountered considerable very nice ore, which was left behind and the shaft cut soap stone, and is in that stuff at this writing. The work is being done by aid of a steam hoist and three shifts of miners are at work.—[Diamond Drill, Crystal Falls.

The Sheridan mine, in the Iron River district, is right in it now, by reason of the fact that a sale has been made of all the ore that can be mined during the remainder of the season, estimated at about 10,000 tons.—[Diamond Drill, Crystal Falls.

The diamond drill at the Wagner had penetrated 53 feet of ground up to Thursday night, the better part of it being in ore of a very fair grade. Mr. Koob, the superintendent, is of the opinion the drill is going in the right direction, and will result in opening a fine body of ore.—[Diamond Drill, Crystal Falls.

Development at the Lee Peck has shown a fine body of ore at the depth of 84 feet. Mr. Wheeler has now commenced the work of sinking the shaft to an additional depth of 50 feet, from which point developmental work will be prosecuted —[Diamond Drill, Crystal Falls.

The Mansfield has shipped nearly 25,000 tons of ore, and is hoisting an average of 250 tons per day. They are running a drift south along the footwall at the second level, and are now 210 feet beyond the timbers, the entire drift being in ore. At this point the vein has widened out to some 28 feet, a gain of from five to eight feet over that at the old workings. The management is preparing to open up another level (the fourth), and the work of cutting out sufficient room for a large new pump is now in progress. Mining from the new level will probably be commenced in two or three weeks. About 100 men are now employed at the Mansfield, and the force will be increased as quickly as men can be procured.—[Florence Mining News.

The Republic mine fire is out at last. Work was resumed in pits one, seven and eight, last week. The only serious calamity the mine has ever witnessed is a thing of the past, but the effects of the fire will be felt by merchants and townspeople there for some time to come.—[Iron Ore.

They are shipping no ore from the Colby, although there are about 80,000 tons in stock. The price has not been what the owners look upon as right.—[Iron Ore.

The Elba shaft is down 212 feet, the sump occupying twelve feet. They are now drifting north and south, crosscutting the formation in the hopes of finding a paying deposit of clean ore. Considerable lean ore has been exposed, and there certainly are numerous signs to indicate the presence of a deposit of merchantable quality.—[Iron Ore.

They are sinking the shaft at the east end Lake Angeline mine, and are now down about 200 feet. Captain Walters will inaugurate the caving system of mining here, working the deposit from the top, which he thinks has some features that commend it for ore located as is this.—[Iron Ore.

At the Dexter mine a diamond drill is being operated in the east end of the property. One hole has been completed and a second started. An improvement is reported in the quality of the ore being mined, it containing 14 per cent. of manganese, 45 of iron, and is much lower in phosphorus than anything encountered for some time past.—[Iron Ore.

Denver's Iron Manufacturing Prospects.

A company has been formed (on paper) with a capital stock of $5,000,000, and the supscribers or the promoters are mostly Denver men. Funds enough have been paid in to make the necessary investigations. These have been carefully conducted, and the facts ascertained are of the most encouraging character. They have discovered an abundance of iron ores, and surrounding them, or conveniently near at hand, abundant fuel and fluxes. They have wisely decided that the blast furnaces should be located at the mines, and the pig instead of the crude ores shipped to Denver. They have entered into detailed calculation of the cost of mining, smelting, and transportation. They have reduced the business to well digested figures, and these show with tolerable certainty that with favorable conditions and superior management, by the application of labor-saving appliances, they can control the market for pig iron lying between the Missouri river and the Pacific Coast. In these msthematical calculations they have taken into account the cost of production in Alabama and Pennsylvania, with which they must inevitaby compete, nor have they overlooked the advantages which their system as at present outlined will possess over the systems employed by their liveliest adversary, the Colorado Coal and Iron Company. Having laid the foundations of their corporation in a solid concrete of facts relating to what they will be able to accomplish, the next thing to be done is, to secure the requisite capital and proceed to build their plants. This should not be difficult. We have no idea that Denver capitalists intend to put five millions of their own money into this entetprese. Many of them will unpoubtedly sake considerable amounts of stock, but the mainspring of the project we imagine will come from Pennsylvania, where most of the skilled labor must be sought.—[Mining and Scientific Review.

A Trifle Did It.

In one of our large establishments connected with the iron industry, the Philadelphia *Record* says, there occurred a few days ago an apparent discrepancy in the accounts involving a matter of 3,000 pounds of scrap iron. The clerks of the department were set to work to unravel the tangled skein, and after they had expended two whole days in the search they were compelled to give up the task and pronounce it beyond their comprehension. Thus matters stood for some days. Several days later the office boy decided to keep himself in practice in addition by footing up a column of figures on a sheet which was lying on a desk beside him in the scrap iron department. Bending his energies to the task he got on swimmingly with the units, tens and hundreds columns, but when he came to the fourth column he could not make it agree with the footing set down. Again and again he tried and with the same result—3,000 less. Going over the figures one by one his attention was drawn to a queer looking one. A fly-speck was beside it in such a position as to make it appear like a four, and as such it had been counted by each of the clerks in the department. The boy had earned his promotion and he got it.

Big Belts Made of Paper.

One of the largest establishments in this country has for some time been turning out paper belts that have the reputation of being superior in many respects to those of leather; these belts are made from pure linen stock, and are of any desired thickness, width, or length, having also a driving power equal to any other from an equal serface, and, while it is not claimed for them that they are adapted to all kinds of work, they are found to serve well as straight driving belts of not less than five inches in width.

Where they have been tested side by side with leather belts for strength and durability, they are alleged to have proved equally satisfactory, adhering very closely to the pulley, generating no electricity while running, being also flexible, and unaffected by temperature within ordinary limits, though there is one place in which they cannot be used, and that is where they have to run in water, or where they would be constantly subjected to moisture.—[New York Sun.

A New Wrinkle in Welding

A new welding method, invented by H. E. Fowler, New Haven, Conn., refers principally to lap-welds for joining the ends of band saws, plates and bars, and the manufacture of water pipes, boiler shells and the like. The process consists in first forming holes in one of the parts to be united so that, when the parts are heated and welded by any convenient means, a portion of the metal of the other part will be forced into said holes, strengthening the joint. In modifications, holes are formed in both the parts to be welded, and in some cases, these holes are made to coincide, and pins or rivets are inserted.

Get Ready to Go.

On the last excursion of the season, via Erie Railway, to Niagara Falls and Toronto, Thursday, September 10. Special train leaves at 8 P. M. Secure sleeping car space at 141 Superior St.

AN ECONOMICAL AIR ENGINE.

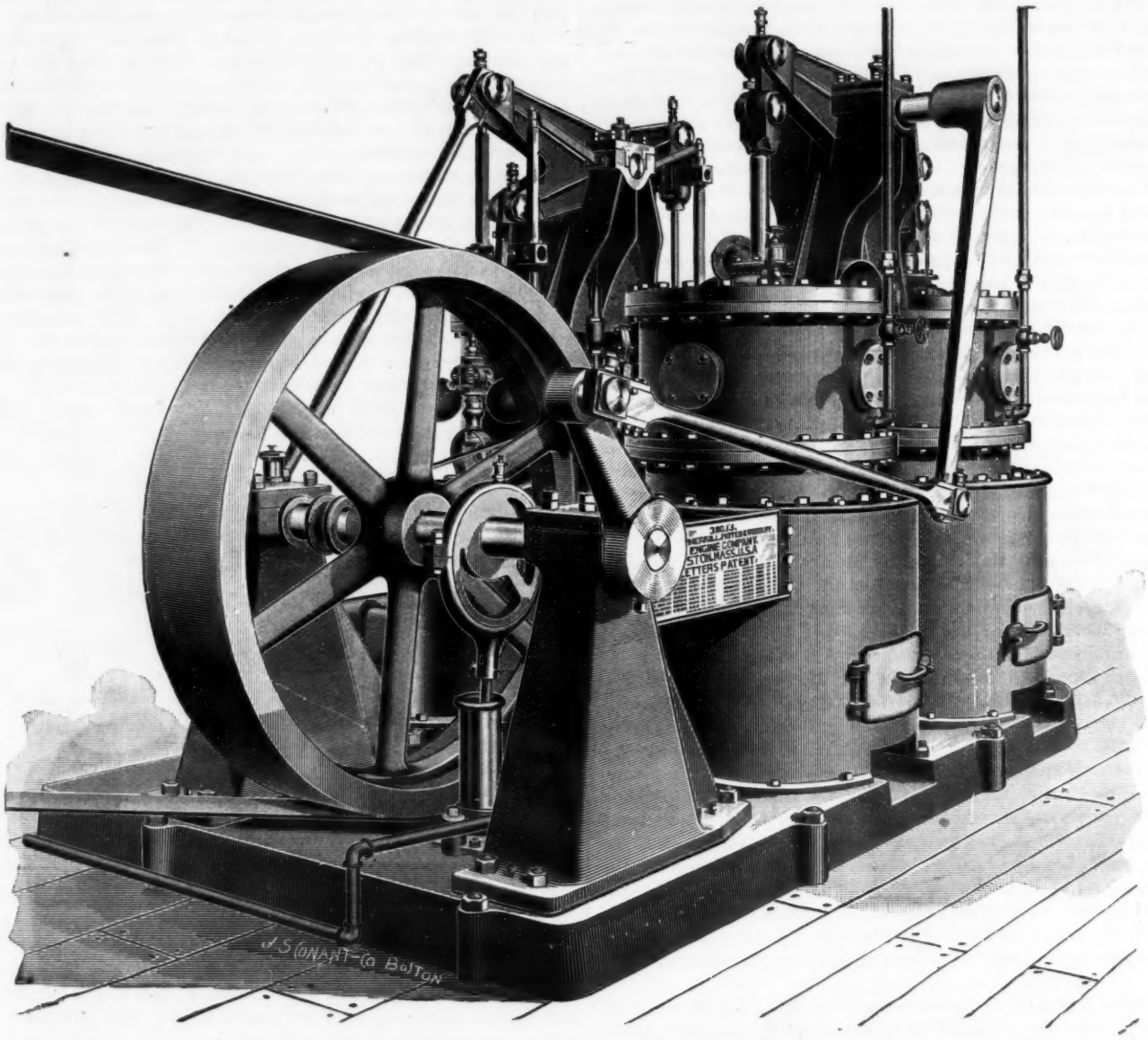
The operation of the engine herewith shown is somewhat different from the operation of the steam engine. The latter takes steam at a given pressure from the boiler and exhausts it into the atmosphere, or into a condenser, using the pressure of the steam to drive the piston. Considering, for discussion, the simplest form of air engine, a constant quantity of air is used to fill its working cylinder and reverser cylinder. The reverser cylinder may be considered as corresponding to the boiler of the steam engine. By proper operation of the reverser, the pressure of the air is alternately raised and lowered, at the proper times to drive the working piston at high pressure and allow it to return at low pressure. The air rushes back and forth through the same connecting pipe, following the motion of the working piston without the use of a valve of any kind.

The engine consists, first, of a furnace of simple and common form, with door, ash-pit, flue and grate, on which a fire is built to heat the lower end of the reverser. This stands above the furnace. The fire is at all times accessible, thus differing from some air engines. The bottom of the reverser cylinder called the "heater" is made of special form and of a special metal and is arranged to be separately renewed. The top of the reverser is a common cylinder head. The reverser consists of two cylinders, one within the other, and having the same vertical axis. The inner cylinder is fitted with a valveless piston having a piston rod. This piston is moved by the engine, and does no work on its crank arm. The inside cylinder of the reverser does not extend to the top or bottom of the outside cylinder, and has no heads, so that there is free communications from below the piston to the top, at all times, no valves of any kind intervening. By the upward stroke of the piston, the air is forced by way of the annular space between the two cylinders to the bottom of the cylinder, and the downward stroke of the reverser piston produces the reverse motion of the air to the top of the cylinder via the same annular space.

The upper portion of this annular space is partitioned horizontally and made into a water-jacketed condenser or cooler, having vertical copper tubes surrounded by flowing water, the tubes allowing the air to pass freely through, as forced by the piston, without coming in contact with the water. The annular space below the cooler extending downward into the "heater," or lower end of the reverser cylinder, is occupied by wire screen cloth. This is called a regenerator. The object of the regenerator is to economize the heat. When the air is moving upward, having just come from the hot surface on account of the air being warmer than the wire, the wire receives a portion of the heat of the air, and the air as it goes upward becomes cooled, first by the wire, then by the water-cooled pipes. The heat which the running water takes up is lost, but the heat in the regenerator is utilized in reheating the air on its return to the bottom of the regenerator. These operations go on at each stroke of the piston. If it were not for the porous nature of the regenerator, which allows the air to be brought so thoroughly in contact with the heated surfaces of the regenerator, it would be impossible to heat and cool the air so rapidly.

The form and action of the "reverser," as the above device is called, being understood, the operation is very easily explained. If the piston of the reverser is forced downward the air in the reverser is cooled, if it is forced upward the air is heated. It is found that it does not matter how quickly this stroke is made, or what the pressure of the air inside the reverser, so perfectly is this device worked out and designed, that when a fire is made, and the heater properly heated, and the water running through the cooler, the air when at the lower end of the reverser is 600° F., and when at the top it is 120° F. And as the pressure is the same on the top and bottom of the reverser piston at any instant, all the power required to move the piston is that necessary to overcome the friction of the air in the regenerator and cooler, which is very slight. The rapidity with which this heating and cooling can be done is a surprise and wonder to engineers and others, in proportion to their familiarity with the difficulties of heating and cooling air. Some of these engines have run two hundred turns per minute, which means the air two hundred times heated and two hundred times cooled per minute.

It is a well-known fact that if a volume of air at any pressure is confined, and its volume not allowed to increase, while its temperature is increased 480°, its pressure will be doubled. On the temperature being decreased 480° again, the pressure decreases to the original pressure. It is to make use of this principle that this engine is designed.



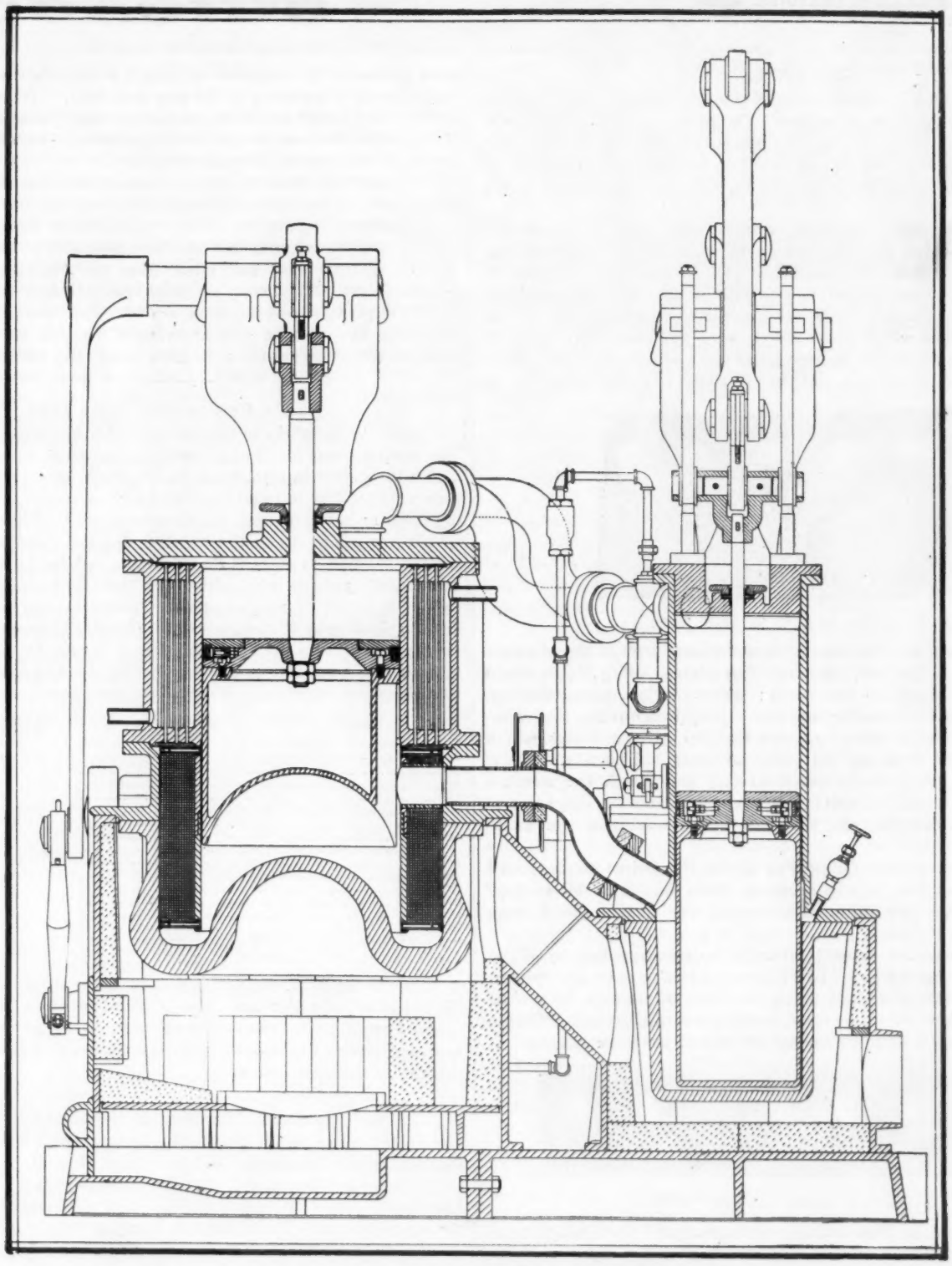
AN ECONOMICAL AIR ENGINE.—PERSPECTIVE VIEW.

It is found that, in using this reverser, very little more coal is required to keep up heat when using four atmospheres, than in carrying one atmosphere pressure in the reverser. The advantages of using the higher pressure is very great, notably in efficiency of engine, less bulk, weight and cost of manufacture and operation. The reverser is connected by a pipe with a cylinder containing a working piston, and the two pistons are connected by mechanism in such a way that the reverser piston is 90° ahead of the working piston, and makes a stroke for each stroke of the working piston. This arrangement produces pressure in the working cylinder varying between pressure due to 120° F. temperature and that due to 600° F. temperature, in the reverser, and the indicator shows a very effective card, more effective as the initial pressure is increased.

When the engine is started it is run on common air, until a small pump which it carries compresses enough air into the engine, say 45 pounds above atmosphere; from that time on this air pump is only called on to supply whatever the leakage may be. An air tank is connected with the engine to store a small quantity of air for starting the engine when under load.

From many considerations it has been learned that the best results are obtained from making the engine in the form shown in the perspective view;

that is, with two reverser cylinders and two double acting working cylinders. The reverser pistons are connected together and balanced by a walking beam, as shown on the right, and are reciprocated by an overhanging side lever, which is connected to the crank arm by its connecting rod. The working pistons are connected together by another walking beam, and drive the engine by means of a connecting rod joined to the third arm of the working side walking beam. In the perspective view the reverser pistons are shown on the right with their two furnaces, the walking beam connecting the two reverser pistons and the overhanging side lever with its connecting rod. These working parts are all driven by the crank arm as shown. The working cylinders on the opposite side are not visible in the picture, but their walking beam and the piston rods show their position. This walking beam, as is seen, has a third arm which is, by a connecting rod, joined to the working side crank arm which drives the shaft carrying the fly wheel The small air pump is shown on the eccentric.



AN ECONOMICAL AIR ENGINE.—SECTIONAL ELEVATION.

The simplicity and durability of this machine will be easily recognized from the absence of all working valves or other complicated mechanism; the only working portions of its interior being four pistons moving vertically, having metallic packings which are perfectly lubricated and operated at a temperature 100 degrees cooler than corresponding surfaces of the steam engine.

From a host of testimonials, we select a few from well-known experts. Prof. R. H. Thurston, of Sibley College, says: "Its best work will obviously be seen in its largest sizes. Throughout the whole series, however, it seems to be be much more economical than the corresponding sizes of steam engine under ordinary practice. The only valuable comparison, however, is that of dynamometric or brake power, and on this basis the air engine has superiority which I should place at not far from 50 per cent., as compared with our best classes of simple or single cylinder steam engine." Mr. Geo. H. Barrus, a widely-known engineer, says, as the result of a thorough test: "Taking the results as they stand, however, the consumption of fuel per effective horse-power transmitted through the belt, is not more than one-half of that required for the best non-condensing steam engines of small power, which are commonly used" Moore & Wyman, South Boston, Mass, manufacturers of elevators, say: "It has given us the best of continuous service for more than a year, and several times we have run the engine for 36 consecutive hours. The cost of fuel per day of ten hours for three months, including fuel used in starting and banking fires, has been a little less than one dollar ($1.00) per day, we using gas house coke at a cost of $4 00 per ton of 2,000 pounds." H C. Patterson, Electrician of the Engineering Department of the Thomson-Houston Electric Co., says: "It is my opinion, based upon some little experience in steam engineering, that in this engine you have made a decided step in advance on the subject of air engines. I am confident that in this you have a perfect, practical and exceedingly economical engine." Manufactured by the Ticonderoga Machine Co., 126 Liberty street, New York.

THE September issue of the *Cosmopolitan Magazine* is a "woman's number" so far as the authorship of its articles is concerned, but the general interest of the periodical is sustained by the variety and timeliness of the topics treated. The opening article, on "Edouard Detaille," is by Lady Dike, and is profusely and beautifully illustrated with reproductions of the famous artist's most noteworthy paintings. "A Forgotten City," by Eleanor Lewis, is a romantic description of the ruins of Solumtum, the Sicilian Pompeii, embellished with photographs. Elizabeth Bisland writes of Tattersall's, the great London horse market. The Countess Ella Norraikow writes of "Woman's Share in Russian Nihilism," her article being illustrated with portraits of many fair conspirators.

A Delightful Daylight Trip.

To Niagara Falls in elegant Pullman day coaches via the Nickel Plate, Sept. 7th Ask Nickel Plate agents. Toronto, $1 extra; Thousand Islands, $5 extra.

STEAM USERS Should Read this.
Increase the Capacity of your Boilers.
Scale is a Non-conductor of Heat.

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PITTED PLATES.

Grooving is often found, in boilers, around the stay bolts of water legs or furnaces, radiating from the bolts as centers. The plates probably bend backward and forward slightly under the varying pressures; and though the flexure and consequent alteration of the surface may be too small to be seen, it may be great enough to start incipient cracks, and open up the iron to the action of the water.

An instance of pitting, which seems to be due to this cause, is illustrated herewith. The pieces which the cuts represent were cut from a horizontal tubular boiler 48 inches in diameter, which had been in use about six years in a nail works. The plates were of steel, one quarter of an inch thick, and the boiler was set over a blast furnace, the waste gases from which are used in the place of fuel. The lap from which these pieces were cut came directly over the vertical flue through which the furnace gases were admitted to the boiler.

Naturally there were great and sudden variations in the temperature to

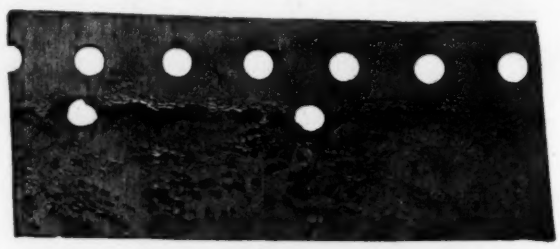

FIG. 1.—A PITTED PLATE (OUTER LAP).

which the lap was exposed, and the expansion and contraction of the plates at the lap must have been sudden and violent. The plates, being light, would readily transmit heat through to the water; while the lap, being thicker, would not part with its heat so readily, and there would frequently be a considerable difference in temperature between the lap and the plates, which would cause the adjacent parts of the plates to twist and buckle slightly. Water would enter the small fissures so produced, and attack the metal, a fresh surface of which would be continually exposed; and the higher and more varied the temperature became, the more active would be the buckling and corrosion.

A good idea of the violent changes to which the boiler was exposed may be had from the fact that at one moment steam would be blowing off freely at 90 pounds, and a few minutes afterward the gauge would show only 40 pounds.

Such changes in pressure would naturally be accompanied by slight changes in the form of the boiler. The lap being stiffer than the plates, the greatest motion would take place along the edge of the lap, where the two come together; and we should expect to find the pitting and grooving most severe at this point. This is the fact in almost every such case. It

FIG. 2.—A PITTED PLATE (INNER LAP).

is indicated in Fig. 1, and in Fig. 2 it is evident that the rivet-heads exercised a similar stiffening power over the inside lap; for the outlines of the rivet-heads may be easily traced by the pitting that took place along their edges, where the motion of the metal composing the inner lap was greatest.

The water in the present case was very pure, so that there was no deposit. Had it been less pure, and contained some light, scale matter, it is possible that this pitting action would not have occurred, as the scale might have sealed the fissures and protected the plates.

When boilers are set as this one was, over a flue leading from a blast furnace, we recommend that the upper end of the flue be curved toward the rear end of the boiler, so that the gases will not impinge directly on the plates, but be delivered horizontally along the under surface of the boiler. Some very troublesome cases of this kind have been cured by this simple expedient.—[The Locomotive.

A New Kind of Power.

A well-known English engineer, Mr. Edward Field, who has introduced a number of important ideas in fuel economy, has discovered a new principle in the use of steam, which promises to be of great value. This principle consists in the use of a mixture of steam and heated air, instead of steam alone, in the cylinder of a steam engine of ordinary type. Demonstrations of the principle and its practical application in an eight horse-power engine have been witnessed by a number of English experts, and their reports ascribe a high degree of economy to the new principle. Mr. Perry E. Nursey, the editor of *Iron*, and a well-known engineering expert, was one of the investigators of Mr. Clark's discovery, and his paper devotes considerable space to a highly favorable description of the principle.

The essential feature of this system is the admission of a small volume of steam into a large volume of heated air, and the use of these mixed gases in the cylinder of the engine. The proportion of these gases capable of giving the best results is about one of steam to eight of heated air. A temperature of not less than 400° nor more than 500° Fahr, was found to be the most advantageous. Mr. Nursey declares that the use of this mixture in the experimental engine showed an economy of 44 per cent. over steam alone, and he expresses the opinion that a saving of between 60 and 70 per cent. will be attained when the system shall have been fully developed.

The Development of the Basic Process.

Jacob Reese writes to the editor of the *Bulletin* (Philadelphia) as follows: The basic process for the manufacture of steel from phosphoritic metal was first made public in 1878, since which time over 13,000,000 tons of steel have been produced by it, together with nearly 4,000,000 tons of phosphate, containing from 17 to 23 per cent. of phosphoric acid. The Bessemer process, which was first given to the public in 1856, did not produce 1,000,000 gross tons of steel in the first 12 years of its existence, and in its twelfth year, 1868, it produced only 308,020 tons, while the basic process in the twelfth year of its existence produced 2,613,083 tons. The basic process in its third year produced 336,000 tons of steel, a larger quantity than was produced by the Bessemer process in its twelfth year. I give below the production of basic steel in each year from 1878 to 1890, so that its steady growth may be seen.

Years.	Gross Tons of Basic Steel Made.	Gross Tons of Phosphate Made.
1878	20	4
1879	1,200	360
1880	50,000	15,000
1881	336,000	100,800
1882	450,000	135,000
1883	634,373	190,411
1884	864,000	259,200
1885	945,317	283,595
1886	1,375 017	412,505
1887	1,704 481	511,344
1888	1,953,234	585,970
1889	2 274,552	682,365
1890	2,613,083	783,924
Total	13 201,277	3,960,478

This is the most wonderful development of an iron or steel process in the history of metallurgy; and, though its adoption in the United States has been delayed by litigation as to the ownership of the patents, now that this matter has been settled I look for a large increase in the output of basic steel in this country in the near future.

Scribner's Magazine for September contains the fifth and concluding article in the Successful Steamship Series, entitled "The Steamship Lines of the World," by Lieutenant Ridgely Hunt, U. S. N., a son of the late Secretary of the Navy and Minister to Russia. This number contains three articles on essentially American subjects—on "Odd Homes," from the dug out to the Adirondack cabin; on "China Hunting in New England," particularly along the Connecticut River Valley, with an account of many rare American plates, which it was once the custom to make as souvenirs of important events; and (the third) on "Present Ideals on American University Life," by Prof. Josiah Royce, of Harvard, who pleads for the idealization of our colleges, rather than their further adaptation to practical ends. Other important articles in this issue are "Browning's Asolo," by Felix Moscheles, the artist and friend of Browning, a picturesque and personal account of the little Italian village where the poet's last volume, "Asolando," was written, with illustrations from the author's own water-color sketches; a description of "The City of the Sacred Bo-Tree," by James Ricalton, a veteran traveler and photographer, whose account of the wonderful city in Ceylon is abundantly illustrated; Andrew Lang's "Adventures Among Books," a sort of literary autobiography; the second installment of the serial story, "The Wrecker," by Robert Louis Stevenson and Lloyd Osbourne; and short stories by Thomas Nelson Page and Charles G. D. Roberts.

First-class Throughout.

The past reputation for affording excursionists first-class accommodations and ample seating capacity will be fully maintained on the Nickel Plate daylight excursion of Sept. 7th. Call on agents or read the bills. Toronto, $1 extra; Thousand Islands, $5 extra.

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IT IS A PERFECT WONDER
FOR DURABILITY AND EFFICIENCY
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THE HACKNEY HAMMER CO. CLEVELAND, O.

A NEW IDEA IN BOILERS.

The *Journal of Building* calls attention to a new idea in boiler construction, a subject at all times interesting to manufacturers: That steam boilers are subjected to extremely destructive strains when the furnaces are first started for raising steam is due to the fact that those portions of the boiler surrounding the furnace become highly heated, while the more remote parts remain for a long time comparatively cool. Hence, there is uneven expansion of the metals, and the consequence is that strains are set up in the boiler, which shorten its life, and are otherwise very prejudicial. To remedy this Mr. C. E. Hudson, a naval engineer of experience, has devised a simple, ingenious system, which he designates the "Pyro" combination, and which has had a successful practical trial on board a merchant vessel. The arrangement consists in substituting for the present furnace fronts steam heating chambers of the same strength as the boiler. These chambers, which do not interfere with the grate furnace, are at starting filled with water from the bottom of the boiler, or from any point in the boiler where there is no circulation. A small fire is lighted in the furnace at first, which heats the water in the chambers, and by degrees the remainder of the water in the boiler becomes heated, and the shell is gradually warmed, a uniform temperature being attained. During this period there is neither pressure nor steam used, and as soon as the circulation ceases by reason of the accumulation of temperature, the heaters become auxiliary boilers, assisting the larger one. As soon as the temperature has become uniform, the fires are hurried, and steam is raised to the working pressure. The primary work of the heaters being accomplished, the chambers are used as feed water heaters. The feed water, instead of going into the boiler direct, is diverted into the heaters and becomes heated to a temperature of 200° F. It will thus be seen that the arrangement is that of a combined automatic circulator and feed water heater, which not only does not rob the boilder of steam, but arrests and utilizes heat which would otherwise be wasted, or rather worse than wasted, as it radiates into the stock hole, and in some circumstances renders it unbearable. The steamship on which the system has been at work for nearly two years is the Cariganshire, a vessel of nearly 3,700 tons. The results of its application are stated by the engineer in charge to be entirely satisfactory. There has been no trouble whatever with it, and the temperature in the stroke hole is found to be reduced by 27 degrees. A further important point is the fuel economy, a saving of seven per cent. being shown on the average of five voyages.

THE subject which will probably attract the widest interest in the *Century* for September, is the discussion of the "Treatment of Prisoners at Camp Morton," Indianapolis, during the war, a discussion begun by Dr. John A. Wyeth's article in the April *Century*. The present number contains a reply to that article by Col. W. R. Holloway, who during the war was private Secretary to Governor Morton. The Gold-hunting Series has an addition in a paper by Col. A. C. Ferris, describing an adventurous trip of a party of gold-hunters to California in 1849 through Mexico, which is attractively illustrated by Remington and Gilbert Gaul. Mr. Kennan contributes the opening article on "A Winter Journey through Siberia." The frontispiece of the number is a portrait of Thomas Bailey Aldrich. In a series of Italian Old Masters, Mr. Stillman comes to Francia and Ghirlandaio, and a single example is presented of each, the engraving of the portrait attributed to Francia being one of the most notable wood engravings ever published in the *Century*. The Hon. Henry Cabot Lodge contributes a curious and suggestive study of "The Distribution of Ability in the United States," which is made the more interesting by a series of tabular classifications. President Seth Low considers "The Government of Cities in the United States." E. W. Howe, editor of the Atchison *Globe*, has a description, both humorous and thoughtful, of "Country Newspapers" as they look from the editor's sanctum. In "The Possibility of Mechanical Flight," Prof. S. P. Langley, Secretary of the Smithsonian Institution, narrates experiments upon which he has been engaged for the last four years in the solution of this problem, and records his belief that "before the century closes we shall see this universal road of the all-embracing air, which recognizes none of man's boundaries, traveled in every direction." In the editorial department are articles on "The Sub-Treasury Cheap Money Plan," in continuation of the financial series, and on "Notable Civil Service Reform Gains" and "Progress of Ballot Reform."

Chautauqua, Niagara Falls and Toronto.

Remember the last excursion of the season to Niagara Falls and Toronto, via the Erie Railway, Thursday, September 10. Special train departs from Central passenger station at 8 P. M. $3 to the Falls, $4 to Toronto. Secure sleeping car space early. City office 141 Superior St.

CENTRAL THOMSON-HOUSTON COMPANY,
48 ARCADE, CLEVELAND, O.
S. D. NESMITH, - - - - - - Manager.
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ELECTRIC LIGHT PLANTS INSTALLED,
Arc and Incandescent, Direct and Alternating,
ELECTRIC FANS!
FANS FOR VENTILATING!
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INDUSTRIAL SUMMARY.

New Enterprises:—

There is talk of establishing works for manufacturing cars for the unicycle elevated electric railway of E. M. Turner, St. Louis, Mo.

The Mills Improved Pneumatic Brake Co., of Chicago, was incorporated in Illinois, last week, with a capital stock of $600,000, by W. Mills, W. B. Mills and O. A. Bogue.

In connection with the Dennis & Roberts machine shop, at Watkins, N. Y., E. H. Spicer intends to establish a molding plant. A cupola will be built and castings of all kinds produced.

H. R. Osborn, Auburn, N. Y., has gone into the manufacture of the Diamond Gas Light Machine, in partnership with his father, Dr. B. E Osborn, who is the inventor, at Syracuse, N. Y.

The National Car Wheel Co. has been incorporated at Chicago, for the manufacture of car wheels; capital stock, $100,000; incorporators, Chas. L. Billings, Albert E. Peters and George Piton.

The Peoria Fence Co., of Peoria, Ill., has been organized for the purpose of manufacturing and selling a combination wire and iron fence. Frank Garthuvit and Martin V. B. Cumetford are the incorporators.

F. N. Groff, A. A. Day, H. J. Bowdoin, of Ohio, S. Foster, of Utica, N. Y., and others have incorporated the Foster Bros. Manufacturing Co, at Baltimore, for the manufacture and sale of wire beds, bedding, etc.

The Chicago Equipment Co. has been formed to manufacture and deal in cars, locomotives, rails and all kind of railroad supplies; capital stock, $1,000,000; incorporators, R. H. Pugh, R. Wilbeforce and H. S Monroe

The Wagner Electric Manufacturing Co., St. Louis, has been incorporated; capital, $25,000; to manufacture, hire and sell electric apparatus, machinery supplies, etc. The promotors are H. J. Wagner, E G Ellis, A. Blair and F. Schwedtmann.

The Standard Nut Lock Co. has been formed with office at Newark, N. J., for the manufacture of nut locks. The capital stock is $100,000. A M. Ake, W. W. Blanchard, E. Harrison, F. C. Blanchard, of Newark, N J., and W. A. Redding, of Brooklyn, N. Y., are the stockholders.

The Extensible Car Step Co. has been incorporated, with office at Kalamazoo, Mich., and capital stock of $100,000. The company will manufacture extensible car steps. The stockholders are: Hiram B. Peck, Kalamazoo; Milton E. Company, Hamilton; A. M. Granger and George S. Johnson, of Grand Rapids.

The Richards' Momentum Brake Co., of Jersey City, N. J., has filed articles of incorporation, the capital stock being placed at $100,000. The company will manufacture and place upon the market the Richards' patent momentum car brake. The interested parties are H. S. Richards, of Orville, Pa; Lindley Murray, 28 Seventh Ave., Brooklyn, N. Y., and A. A. Rice, Jersey City, N. J.

The American Metallic Steam Packing Co. has been incorporated for the manufacture of metallic steam packing for stationary and other engines, pumping and other machinery, by A. H. Twining, W. B. Davis and H. J. Hayden, of Reading, Pa.; H. C. Horton, Philadelphia, and S. Livermore, Camden; authorized capital stock, $200,000. The office of the company will be at Camden, N. J.

Articles of incorporation of the Minneapolis Malleable Iron Co. have been filed in Minnesota. The capital stock is $50,000. The works will be located at St. Louis Park, Hennepin County, Minn. The following are the directors: Geo. T. Leitch, A. M. Allen, G. M. Walker, Minneapolis. G. M. Walker is President, G. T. Leitch, Vice president and Manager, and A. M. Allen, Secretary and Treasurer.

The Hanover Foundry & Machine Co., recently was organized at Hanover, Pa., with a capital stock of $40,000, with privilege to increase to $100,000. The size of the machine shop will be 90 x 100 feet, of the foundry 60 x 70 feet, and other buildings will be erected. The company will manufacture engines, threshers, all kinds of mill machinery, including paper mill machinery, and will occupy the saw shops about the first of December.

The following are among the new Illinois incorporations: The Metal Building, Finishing & Furniture Co., of Chicago; capital, $600,000; incorporators, A. G. Herrington, I. T. Dyer and John Irvine.—The Litchfield Thresher Manufacturing Co., of Litchfield; capital, $15,000; incorporators, G. L. Zink, H. H. Beach and others.—Mexican Electric Steam Boiler Compound Co., of Chicago; capital stock, $100,000; incorporators, C. M. Lawson, J. R. Perry and J. H. Pritchard.

Additions, Enlargements, Removals, etc.:—

It is stated that the Warren City Boiler Works, of Warren, O., will remove to Middlesborough, Ky.

An addition is being made to the Phœnix Roll Works of Seman, Sleeth & Black, Pittsburgh, which will give to the machine shop increased space

amounting to about 4,800 feet. New machinery will be added when the building is finished.

The Woonsocket (R. I.) Machine & Press Co. has been making quite extensive additions to its works.

The Excelsior Iron Works, Chicago, will erect a five-story machine shop, 74x91 feet, at a cost of $40,000.

The Pitman Manufacturing Co., of Laconia, N. H., are to build new buildings at the expense of about $20,000.

Plans are being prepared by the American Tube & Iron Co. to extend its Youngstown plant and increase the production.

The Blake & Johnson Co., of Waterbury, Conn., are about completing a new machine shop, 200x45 feet, two stories high, with basement and storage-rooms.

A new mill for merchant bar iron will be constructed, at Anniston, Ala., by the United States Rolling Stock Co., which now has 14 puddling and heating furnaces in operation.

The Buffalo (N. Y.) Steam Forge Co., which has been operating the Sayre Forge, at Waverly, N. Y., has decided to remove the latter works to Buffalo, where the main plant is located.

The plans adopted for the new buildings of the Hanover Foundry & Machine Co., at Gettysburg, Pa., embrace a machine shop, 90x40 feet, and a foundry 60x70 feet, both of brick.

The president of the Bessemer Pipe Works, Bessemer, Ala., has said that his company will double the present capacity of that plant in the near future. The pay roll now numbers about 600 men.

Additions are being made at the iron axle mill of Irondale, O., which, it is stated, when completed, will be used for the manufacture of tinplate. The mill will be fitted up with the latest machinery for the manufacture of tinplate, and will give employment to about 75 more men.

The W. H. Warren Machine Tool Works, at Worcester, Mass., has received a $25,000 contract for building machinery for the Watervliet Arsenal, at West Troy, N. Y., and has just sold the fifth patent radial drill to go to England. The works never before had so many orders ahead, and will treble capacity so soon as shop can be finished.

General Industrial Notes:—

The Lowell (Mass.) Steam Boiler Works, recently destroyed by fire, are to be rebuilt at once on a much larger scale.

The American Nail Works, of Anderson, Ind., has completed arrangements by which it will galvanize its entire product of wire.

The suit over the Ball engine has been decided in favor of the Ball & Wood Co., of New York, by the United States Circuit Court.

C. W. Woodford, of Port Henry, N. Y., has just completed a horse-nail plant for export to South America, being the first manufactory of the kind introduced into that part of the world.

The Ticonderoga Machine Co., 126 Liberty St., New York City, have just sold a 65 horse-power engine to be used for electric light purposes in James Hill's new building at St. Paul, Minn.

The tinplate manufactory at Apollo, Pa., is producing plates 28x100 inches, which is five times as large as the Welsh plates, which were only 20x28 inches. The new size is said to be much more desirable for roofing purposes, and those who have seen it say it is "of the best steel, fully coated, redipped, and without a blemish."

We are in receipt of the latest catalogue of The James Leffel & Co., which is a fine specimen of printer's work, and shows that much care and time has been spent by Leffel & Co. in preparing it. The book gives a full explanation of the "Old Reliable" Leffel turbine water wheel, which they have been manufacting for a good many years, and which has acquired a high reputation for excellence and durability. Anyone wanting a turbine wheel should write them.

Cast Iron Tunnels.

Two tunnels of cast iron for an electric railway have been built in London and put in operation for rapid transit. They are three miles in length and lie between 40 and 60 feet below the surface of London streets. The tunnels for the up and down lines are formed of cast iron from beginning to end, save where the stations are built, and their diameter is 10 to 10½ feet. The tubes are formed of rings one foot and seven inches long, made in sections and bolted together. The tunnels are driven by means of a short cylinder, a trifle larger in its inner diameter than the exterior diameter of the cast iron tunnel lining. This cylinder has a cutting edge, and is forced forward by hydraulic jacks, cutting a circular way into which the lining plates are fitted. The narrow space between the lining and the soil was filled with lime cement forced in under high pressure. In their course the tunnels pass beneath the bed of the Thames and through the bed of an old watercourse, where loose, wet gravel offered some trying obstacles for the engineers to overcome. The entire cost of the line, fully equipped, was less than $3,750,000.

IN the September *Wide Awake* there is good history, biography and travel (see "The Prince Imperial" and "Stanley's Bananas"), outdoor sport and indoor ethics (see "Two Fishermen," "The Margaret-Patty Letters" and "All Because a Bluebird Sang"), curious natural history (see "How I Tended Silk-worms," "An Odd Set," and "Two Acquaintances of Mine"), fanciful tale and the higher sort of fairy story (see "Peterkin and Pollikin go to the Fair," and "A Tale of the Black Forest"), practical art-lessons (see "Drawing the Child-Figure"), a masterly serial (see Margaret Sidney's "The Peppers Grown Up"), a fine array of short stories (see Mrs. Bate's "Red Lilies," Mrs. Sherwood's "Sovereign of '45," Clarissa Potter's "Aunt Betsey's Cap Box," etc.), etc.; $2.40 a year. D. Lothrop Co., Boston.

THE last excursion of the season to Niagara Falls and Toronto, via Erie Railway, leaves Erie depot Thursday evening, September 10.

THE STIRLING COMPANY

MANUFACTURE

The Safest, Most Economical, Compact and Durable High Pressure

WATER TUBE BOILERS.

All Wrought Steel. Large Mud Drum. Perfect Circulation.

By removing four manhole covers access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed

GENERAL OFFICE: Pullman Bldg., Chicago. PITTSBURGH OFFICE: Lewis Block. NEW YORK OFFICE: 74 Cortlandt St.

Works: BARBERTON, SUMMIT COUNTY, OHIO.

KING OF THE ROAD MAKERS.

FORSTER'S PATENT

Rock Breaker

For Macadam.

properly cubed. No gear wheels to break. Product 10 to 200 tons per day according to size. Over 450 in use FOR COARSE OR FINE CRUSHING. Does the work of any other breaker with ⅓ the power and ⅛ the expense for keeping in repair.

Only manufacturers. Correspondence solicited.

TOTTEN & HOGG FOUNDRY CO., 23rd St. and Railroad Ave., Pittsburgh, Pa.

HAS YOUR WAREROOM BEEN ROBBED?

Our corrugated or plain Iron or Steel SHUTTERS and DOORS will render it Fire and Burglar Proof. We also cover wooden shutters and doors with flat painted sheets, either plain or with corduroy corrugations. For prices, etc., address

The Cincinnati Corrugating Company,

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DIXON'S GRAPHITE PAINT

THOSE who use it say that one pound will cover 2 to 3 times more surface and last 4 to 5 times longer than any lead, mineral or metallic paint. A tin or iron roof well painted will not require repainting for 10 to 15 years.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

MUNN & CO. SCIENTIFIC AMERICAN AGENCY for PATENTS

A pamphlet of information and abstract of the laws, showing How to Obtain Patents, Caveats, Trade Marks, Copyrights, *sent free.* Address MUNN & CO. 361 Broadway, New York.

Advertising.

IF you wish to advertise anything anywhere at any time write to GEO. P. ROWELL & CO., No. 10 Spruce St., New York.

EVERY one in need of information on the subject of advertising will do well to obtain a copy of "Book for Advertisers," 368 pages, price one dollar. Mailed, postage paid, on receipt of price. Contains a careful compilation from the American Newspaper Directory of all the best papers and class journals; gives the circulation rating of every one, and a good deal of information about rates and other matters pertaining to the business of advertising. Address ROWELL'S ADVERTISING BUREAU, 10 Spruce St., N. Y.

Plate Iron Washers

A SPECIALTY!

Even in Gauge, smooth and well finished.

Cut from new plate, rolled expressly for the purpose. Write for prices, Address,

MILTON MFG. CO., Milton, Pa.

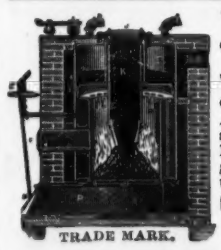
S. T. W. Ejector.

For Raising Water from Deep Wells, Streams, Excavations, &c.

The cheapest made. Send for prices.

JAMES JENKS, Manufacturer, DETROIT, MICH.

M. P. SATTERTHWAITE, Agt., Cleveland, O.



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The Dunnning Boiler,

OLDEST AND BEST FOR STEAM and HOT WATER HEATING.

Over 16,000 in use. Also Steam Engines and Boilers of all kinds and Machinery generally. Manufactured at the

N. Y. CENTRAL IRON WORKS.

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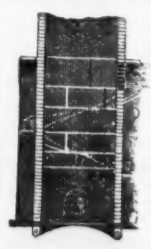


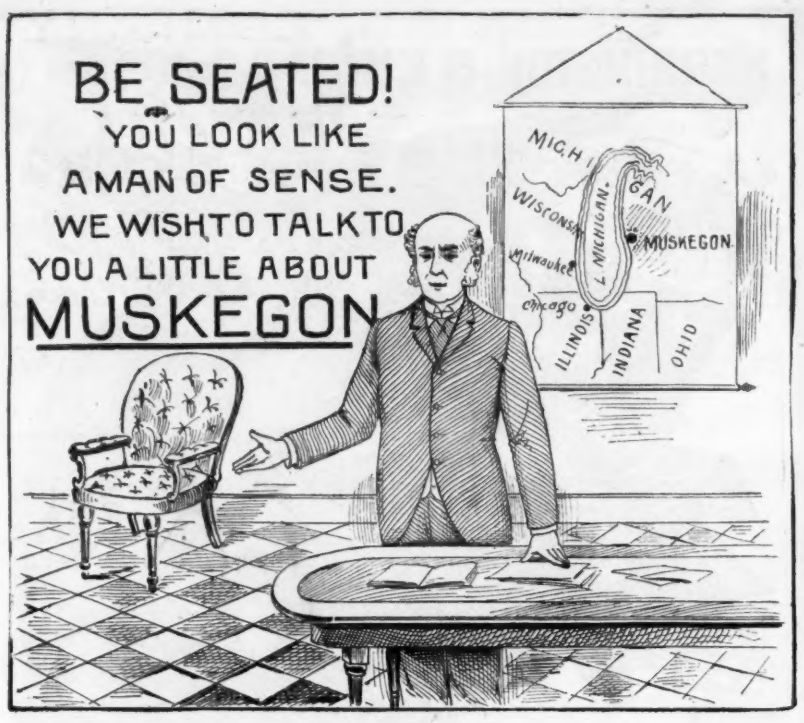
VICTOR COLLIAU,

Sole Manufacturer of the

Improved Patent HOT BLAST COLLIAU CUPOLA

ADDRESS:

287 Jefferson Ave., DETROIT, - MICH.



I wish to say to you that for the Manufacturer or Investor

THE CITY OF MUSKEGON, MICH.,

offers greater opportunities, has more real merit than ANY young City of the United States.

I AM aware that this is a BOLD STATEMENT, but I am prepared to give **Facts and Figures that will astonish you.** Notice this map on the wall, the Lake Michigan District, four States, having a common center (Lake Michigan). These four States, bordering on the **only** great body of water lying **wholly** within the United States, have an average age as States—61 years—and no district of the world ever made such a **record.** These four States: Illinois, Indiana, Michigan and Wisconsin, had, by the census of 1890, 9,781,255 population, or nearly **one-sixth** of the entire population of the Union; they have over **one-fifth** of the railway mileage of the United States, and over **one-tenth** of the railway mileage of the **world;** and talk about rapid growth—**Look at this table:**

NAME OF STATE.	GAIN LAST 30 YEARS.	PRESENT POPULATION—1890.
ILLINOIS	2,106,585	3,818,536
INDIANA	1,514,117	2,189,030
MICHIGAN	1,340,679	2,089,792
WISCONSIN	907,016	1,683 897
TOTAL	5,868,397	9,781,255

This 30 years gain—5,868,397—is MORE than the present ENTIRE POPULATION of the following FIFTEEN STATES, viz:

1	California	1,204,002
2	Colorado	410,975
3	Connecticut	745,861
4	Maine	660,251
5	Vermont	332,205
6	New Hampshire	375,227
7	Rhode Island	345,343
8	Delaware	167,861
9	Montana	131,769
10	Nevada	44,327
11	Washington	349,516
12	Utah	206,498
13	Oregon	312,490
14	North Dakota	182,425
15	South Dakota	327,848
	Total	5,796,598
16	West Virginia	760,448
17	Maryland	1,040,431
18	Florida	390,435
19	Idaho	84,229
20	New Jersey	1,441,017
21	Wyoming	60,589
22	New Mexico	144,862
	Total	9,718,609

NOTE:—

MICHIGAN, which is twenty years younger than Illinois or Indiana, made nearly

23 PER CENT.

of the entire gain of this four-state district for the last thirty years.

THE FOUR-STATE GAIN WAS 5,868,397.

The present population of this four-state district is 9,781,255 or MORE than the 22 opposite: ☞

See U. S. Census 1890.

NOTE.—Michigan gained more population in the last **30** years—see table above—than the present entire population of Connecticut, Vermont and Delaware combined, or within 5,000 as much population as Oregon, Washington, Colorado, Montana and Nevada have combined.

NOTE.—Michigan gained more population in the last **10** years than **Virginia and Georgia** together gained, or than **Kentucky and Tennessee,** or **Alabama and Mississippi** combined gained.

YOU ARE SURPRISED AT THIS.

It was your impression that all the growth and wealth of this district was at the south end of Lake Michigan, but let me tell you right here that the great intrinsic wealth is farther north, in the Iron, Copper, Salt and Timber district. The hardwood forests have scarcely been touched. Michigan puts out yearly over half the Iron Ore mined in the United States; more than all the Southern States combined. Nearly every pound of Steel made in Pennsylvania and Ohio is made from Ore coming from this district, 96.3 per cent of the Steel output of the United States for 1890 is accredited to six States lying along the **Great Lakes** and this output was 100,000 tons more than that of Great Britain for 1889—**MICHIGAN FURNISHED THE ORE.**

When You Have Absorbed

THE

FOREGOING FACTS AND FIGURES

You are beginning to reach a point where you will appreciate the location of the City of

MUSKEGON.

Notice on this Map on the wall, and in the Cut below,

MUSKEGON'S CENTRAL LOCATION

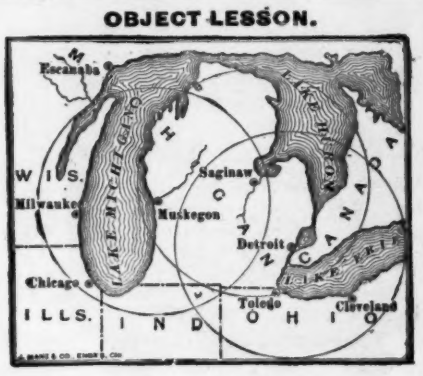
IN THIS GREAT

TEN MILLION POPULATION DISTRICT.

IT HAS THE BEST LOCATION IN MICHIGAN.

LOOK AT THIS!

OBJECT LESSON.



3 MICHIGAN CIRCLES.
NAVIGATION CITIES.

Radius of Each Circle, 125 Miles.

POPULATION:—Each Circle has in round numbers in United States population as follows:

SAGINAW CIRCLE, - -	**1,725,000**
DETROIT CIRCLE, - - -	**2,600,000**
MUSKEGON CIRCLE, - -	**2,725,000**

NOTE.—See Cram's Atlas, Census 1890, by Counties.

The great business centers of this Lake Michigan District are the Coast Cities. Muskegon is third in size on this great body of water and has the finest natural inside Harbor on Lake Michigan, sixteen miles of water front, all available, deep water—114 miles from Chicago and 85 miles from Milwaukee, with which two cities **navigation is open the year round.** Only 175 miles by navigation from the greatest **Bessemer Ore** shipping docks in the **world.** Rare combination—**Raw Materials, Best Shipping Facilities and Best Markets** in the United States.

IT IS AN ACTUAL FACT that cargoes of heavy merchandise can be carried from **Muskegon** to the business center of **Chicago quicker** and for **less money** than the same quantity can be brought in **by rail** from points 10 to 15 miles outside the limits of Chicago. No experiment. Doing it now.

These great advantages are beginning to be appreciated. Twenty-one factories hav been located in the last eighteen months. Among the factories secured are: **The Alaska Refrigerator Co., Large Rolling Mill, New Steel Works, Chase Bros. Piano Co., Sargeant's Invalid Chair Co., Nelson Piano Co., Mich. Washing Mach. Co., Malleable Iron Works, Machine and Foundry Co., Electric Alarm Co., Shaw Electric Crane Co., Houck Furniture Co., Electrical Power Co., Muskegon Cracker Co., Standard Oil Co. Barreling Works, Morton Key Seating Co., Kelly Bros. Mfg. Co., Heaps Earth Closet Co., Gray Bros. Mfg. Co., Hartshorn Shade Roller Co., New Flouring Mill**—All just completed or now building.

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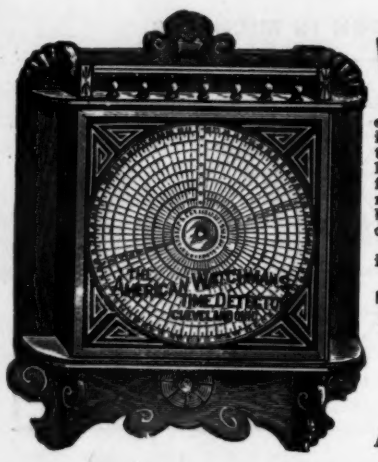

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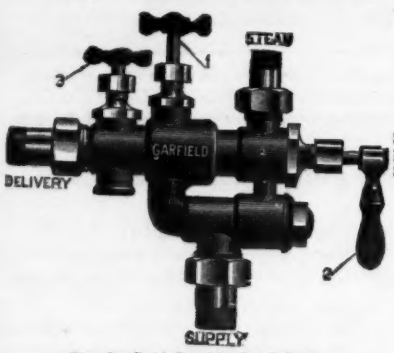

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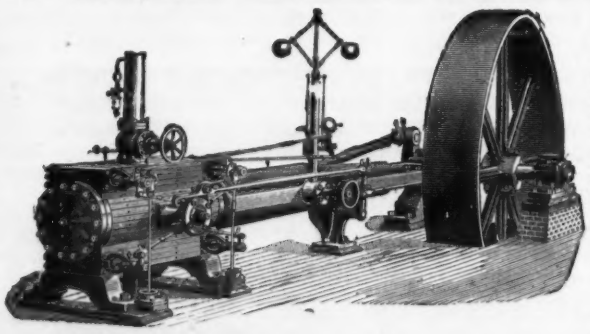

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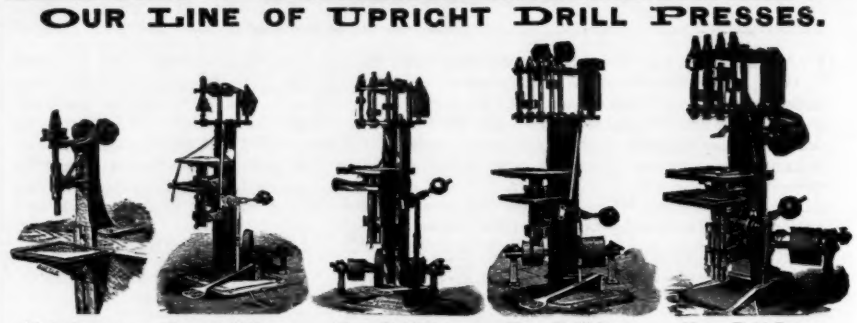

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1 to 1⅜ inch	1 80
1 to 2⅝ inch	2 00
2¾ to 3¼ inch	2 20
3½ to 4 inch	2 80
4¼ to 4½ inch	3 30
4¾ to 5 inch	3 50

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¼ to 1¼ inch	2 20
⅜ to ¾ inch	2 70
⅞	3 60
⅝	3 00

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1¼ to 3 inch	2 90
⅞ to 1¼ inch	2 50
⅞ to ¾ inch	3 10
⅝	3 30
½	4 80

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¼ to 6 by ¼ and 5-16 inch	2 00
¼ to 1⅜ by ¼ and 5-16 inch	2 10
¼ to ⅞ by ¼ and 5-16 inch	2 30
⅜ to ¾ by ⅜ and 5-16 inch	3 80

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1¼ to 4, Nos. 13 to 15	2 60
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¾, Nos. 19 and 20	3 70
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1¾ to 6 by ⅛ to 3-16 in	2 20
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⅞ and 13-16 by ⅛ to 3-16 in	2 70
⅞ and 1 3-16 by Nos. 11 and 12	2 80
¾ and 11-16 by ⅛ to 3-16 in	3 00
¾ and 11-16 by Nos. 11 and 12	3 10
⅝ and 9-16 by ⅛ to 3-16 in	3 30
⅝ and 9-16 by Nos. 11 and 12	3 40
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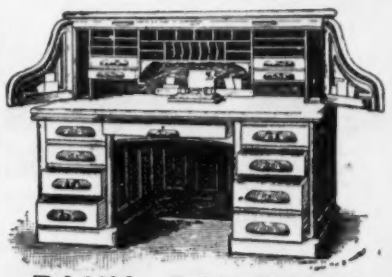

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" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1⅜".....dis 50&10
Morse Taper and Straight shank Larger than 1⅜".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2¾c
¼ kegs ₩ lb	4¼c	5¼c		2¾c
⅛ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
5 lb cans, less than 1	10 c	10 c		7½c

Emery Cloth and Paper.

Garder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
Industry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	⅜	5-16	½	⅝	¾	⅞	1
Square	8	7	5½	4½	4	3½	2½
Hexagon	15½	11½	8½	6	5½	5½	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 00
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ½ inch and over.....₩ lb 15¾
Sisal, ½ inch and over.....₩ lb 13½

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@10
" Band.....dis 20
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 33
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron.....dis 72½
Round head iron.....dis 67½
Flat head brass.....dis 72½
Round head brass.....dis 65
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5 25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ⅜ lb Balls		21c@29c
No. 18 " " ¼ and ⅜ "		18c@28c
No. 36 " " ¼ and ⅜ "		16c@27c
2-Ply Hemp, ¼ & ⅜ lb Balls (Spring Twine)		11½c
3-Ply " 1 lb Balls		12@12½c
3-Ply " 1½ lb Balls		11@11½c
Cotton Wrapping, 5 Balls to lb		15@16c

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 25

Wire.

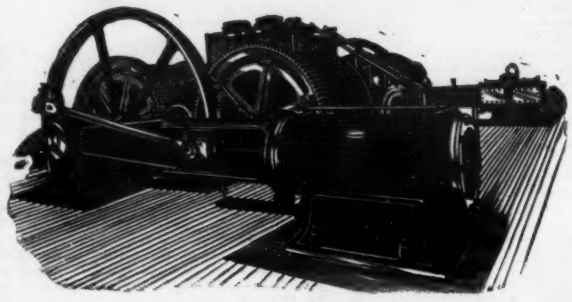
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire, regular.....$5.00@lb dis 1

Wrenches.

Coe's genuine.....dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 1
Bemis & Call's Combination.....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



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Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves. Cages, Buckets, Etc.

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CLEVELAND. O.
LIGHT AND HEAVY
IRON CASTINGS.
DAILY MELTING CAPACITY 75 TONS-SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.
DUPLICATE WORK A SPECIALTY.

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BURNING BRANDS
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Detachable Roller and Chain Belting,

CHAIN

MADE IN ALL SIZES OF Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

For handling materials of all kinds.

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Unequaled for ROOFING AND SIDING.

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Send for illustrated catalogue and prices.

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829 SHERIFF ST. CLEVELAND O.

THE INDISPENSABLE LATHE DOG.

THE INDISPENSABLE LATHE DOGS can be attached to work after the work is centered in the lathe. They can be used equally as well BETWEEN COLLARS as upon plain or straight work.

DROP FORGED FROM BAR STEEL.

No. 1 takes from ¼ to 1¼ inches, price, each.....$1 50
" 2 " ½ to 2¾ " " 2 50
" 3 " 1 to 3¼ " " 3 50
Price, per set of three, to take from ¼ to 3¼ in. 7 50

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607 Market St., PHILADELPHIA, PA.

IRON FOUNDRY CANTON IRON FOUNDRY CO.,
Canton, Ohio.
HEAVY AND LIGHT CASTINGS.
Privilege to make estimates solicited.

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STEAM BOILER FURNACE IN THE WORLD.
SEND FOR DESCRIPTIVE PAMPHLET. THE BRIGHTMAN STOKER Co. 201-203 RIVER ST. CLEVELAND, OHIO.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $7 00
Others.....℔ doz $6 00
Full polished.....℔ doz $8 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&10
Tire, common, new list.....dis 65
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Nuts.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&10
Loose joint, jap.....dis 70&10
Loose joint, jap. with acorns.....dis 70&10
Loose pin, acorns.....dis 70&10
Loose pin, japanned acorns.....dis 70&10
Loose pin, acorns, jap. plated tips.....dis 70&10
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10
Wrought, fast joint, broad.....dis 70&10
Wrought, loose joint, broad.....dis 70&10
Table Butts, back flaps, etc.....dis 70&10
Regular inside blind.....dis 70&10
Light inside blind.....dis 70&10
Loose pin.....dis 70&10
Light loose pin.....dis 70&10

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

	Per roll of 500 sq. feet.
Eberts Bros., Detroit.	
No. 1—Slaters'	$1.25
"A," Stringed Roofing, Light.	1.50
"B," Stringed Roofing, Medium	1.75
"C," Stringed Roofing, Heavy	2.00
Stringed, Rosin-Sized	1.00

MILCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton	$30.00
Asphaltum, Fine Grade, ℔ ℔	.08
Coal Tar Felt, 1 Ply, ℔ ℔	.02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft	1.42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft	1.85
Roofing Pitch, ℔ gal	.09

Chains.

Revised List.
Trace, 6¾-10-2.....℔ pair 1.08
Trace, 6¾-10-3.....℔ pair .92 } .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ ℔5¾@6
Jack Chain, Iron.....dis 75&10
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	3.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber } 5 and Slop } 5X Commode } 14 qt.	6 50	7 50	8 50
Fys. slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11½ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12. dis 25@25&5

Hanger

Barn door, old patterns.....dis 00&10&10@70
Climax, (Anti-Friction).....dis 55
Scranton.....dis 33—
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No. 10	9	8	7	6	
Ausable, ℔ M.	23	24	25	26	28	dis 40
Putnam, ℔ M.	18	19	20	21	23	dis 15
Essex						dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60&10
Escutcheons and keys.....dis 60&10
Padlocks and padlock keys.....dis 75
Bell pulls, mineral, porcelain and jet dis 60&10
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 70
Letter box plates, genuine bronze...dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Levels.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 30
Wostenholme & Butcher.....$10@$...dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ doz $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&...

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&1...
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 2...

Squares.

Steel and iron } dis 75&10@80
Nickel plated }
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis ... &...

Tacks, Brads, Etc.

New List, Oct. 19, 1890.
American iron carpet tacks all kinds dis 77½&10
Steel carpet tacks all kinds.....dis 75&10
Swedes iron carpet tacks, all kinds dis 75&10
Swedes iron tacks.....dis 75&10
Swedes iron Upholsterers' tacks.....dis 75&10
Tinned Swedes iron tacks.....dis 77½&10
Tinned Swedes iron Upholsterers' tacks.....dis 77½&10
American iron cut tacks.....dis 77½&10
Copper tacks.....dis 40&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10
Finishing nails.....dis 60&10
Hungarian nails and miners' tacks...dis 60&10
Gimp and lace tacks.....dis 77½&10
" " " tinned.....dis 60&10
Trunk and clout nails.....dis 72½&10
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10

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ELEVATORS.
L. S. GRAVES & SON,
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BRANCH OFFICES:
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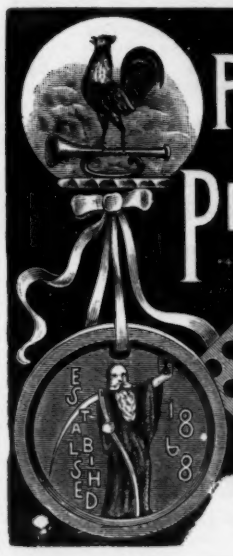
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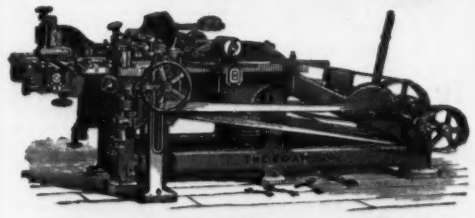
CHICAGO, ILL.
ESTABLISHED 1868
PERFORATED METALS OF ALL KINDS
OFFICE 510---265 to 269 DEARBORN ST.
WORKS AT SOUTH CHICAGO.

THE EGAN CO.,
Nos. 251 to 271 W. Front St., CINCINNATI, OHIO.
Builders and Originators, Designers and Constructors.
Wood-Working Machinery.

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4, 6, 7, 8, 9, 10 and 12-inch.
Geared feed rolls, two above and two in table. Slotted steel heads.
For Every Purpose
Meeting the requirements of
PLANING MILLS,
SASH, DOOR and BLIND FACTORIES,
PATTERN SHOPS,
General Wood-workers etc.
With the latest and most advanced type of machines for fast and perfect work.
Send for Catalogue and information.

AKRON CHEMICAL CO.,
Imperial Car and Bridge Paints.
PAINTS.
Black Asphaltum Paints. All grades.
150 State Street, AKRON, O.

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The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks.

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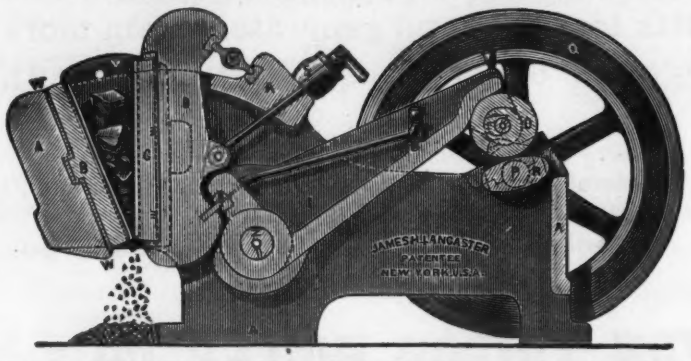

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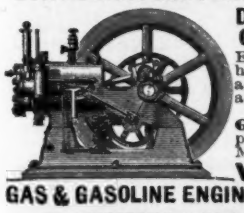

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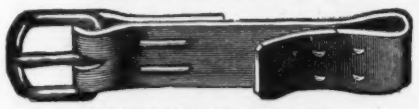

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Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	†1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m.,6:30 p m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.

Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot oot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Chicago Express	*8 35 a m	*10 00 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 20 a m

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From Cleveland Union Station.

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	Arrive.	Depart.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	d5 25 a m d11 40 a m 6 35 p m	7 45 a m d1 40 p m d11 10 p m
Wellsville, Wheeling and Bellaire.	12 30 p m 6 35 p m	7 45 a m 1 05 p m *11 10 p m
Alliance Accom.....	10 10 a m	3 25 p m
Ravenna Accom.....	8 25 a m	5 00 p m

d Daily. *Except Saturday. Other trains except Sunday. Through Pullman Sleepers to New York on 1:40 p. m. train daily.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest	d 7 00 am 5 40 p m	8 00 a m d 8 00 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	12 30 p m	1 05 p m
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No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 2 50 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express...	† 5 15 a m
No. 71, Youngstown Accom.....	* 7 15 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 30 p m
No. 73, Leavittsburgh Local.....	* 2 10 p m
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No, 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

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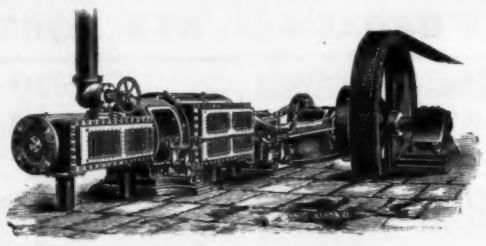

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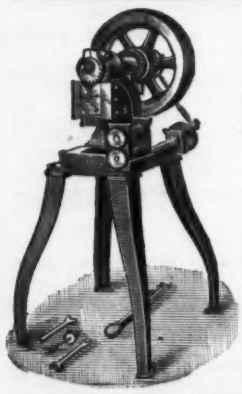

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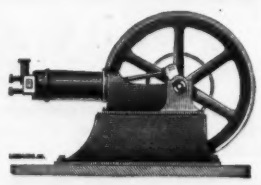

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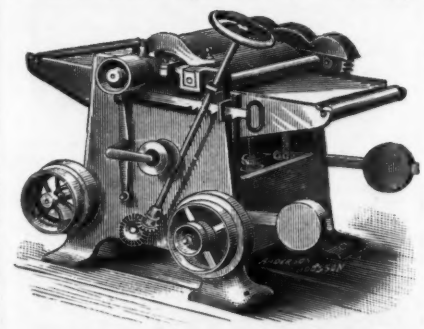

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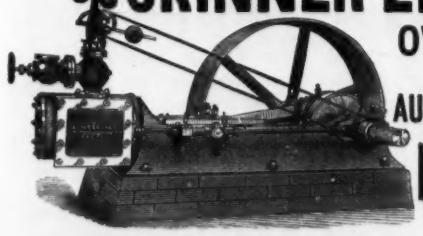

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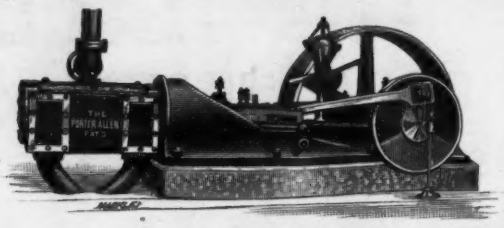

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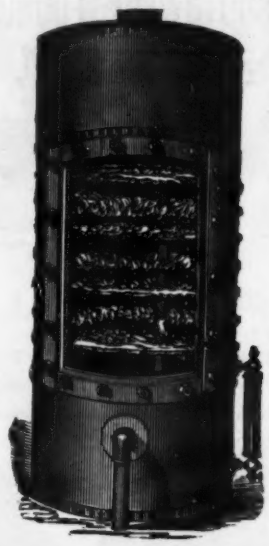

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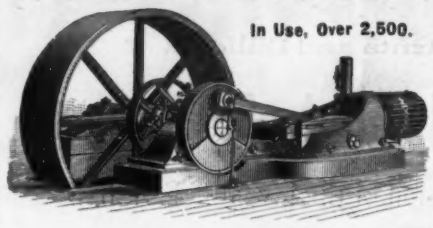

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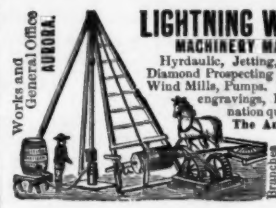

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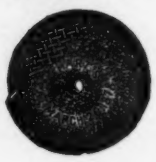

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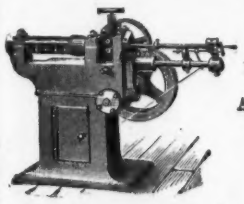

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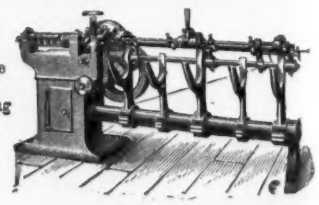

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